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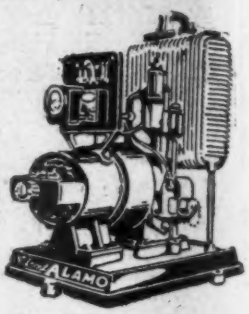

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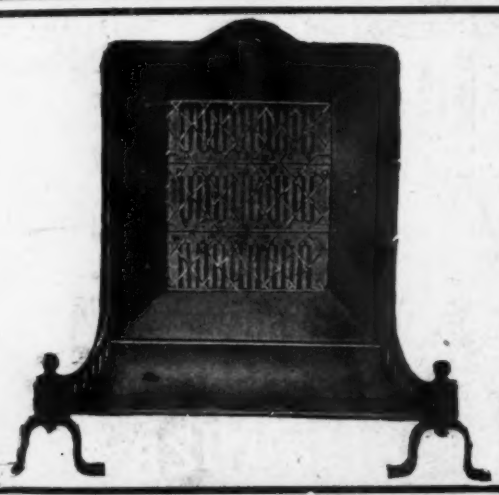

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ELECTRICAL REVIEW.

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HOW ENGINEERING COSTS HAVE RISEN.

AN important paper, comparing pre-war and post-war production costs in the engineering industry, was read before the Royal Statistical Society on April 19th last, by Mr. R. J. A. Pearson, M.Sc., M.Inst.C.E., M.I.Mech.E., and published in our contemporary *Engineering* on April 29th. The subject is one the importance of which is scarcely capable of exaggeration, and the essential fact of price increase touches—if that is the right word—all sections of the community. Systematic investigations of the reasons for price increase have been undertaken by individual firms, and some useful facts were collated and published in tabular form in last July's issue of *BEAMA* by Mr. Frank Walker. We had not, however, until we read this paper, come across any attempt to reduce the facts to a scientific system, acting according to discoverable laws, and capable, therefore, of being used to estimate the future as well as to guide the immediate present. Since Mr. Pearson does not pretend to exhaust the subject, it would, we think, be well if it were taken further, preferably by a paper before the Institution of Electrical Engineers, where it could be discussed fully by those actually engaged in the production of the material and apparatus dealt with.

Four grouped items of cost cover all the expenditure of any industrial establishment, viz., direct wages, direct material, standing charges, and running charges, and since direct wages can be ascertained readily, it is convenient to express the remaining items as percentages of the amount represented by that cost group. Direct material, including sub-contracts, need not be considered under the head of costs, and this item, after receiving mention, is not further dealt with. Indirect material, indirect wages, interest, depreciation, rent, rates and taxes, advertising, insurance, and other expenses incidental to the manufacture and sale of goods, go to make up the oncosts, or those costs which do not vary directly with the amount of the product made.

The ratio between pre-war and post-war rates of wages is shown to vary considerably, in inverse proportion to the degree of skill of the worker affected. The limiting values tabulated by Mr. Pearson are 334.5 and 188 per cent. That is to say, the man who, before the war, was paid £1 per week has risen to £3 6s. 11d., and the man who received £2 18s. 8½d. is now paid £5 10s. 2½d. Mr. Pearson reckons that the cost of supervision has increased in the ratio of 100 to 175, but here we think he has decidedly overestimated the increase. If design and sales staffs are included, the estimate is certainly on the high side, and this is borne out by the financial results of some of the concerns to which this paper might be applicable. Commercial charges, before the war, bore a certain ratio to works cost, and in many instances that ratio has continued to be used right up to the present time, with the result that commercial expenses have been considerably overabsorbed, and profits have been vouchsafed to those who never knew what it was to pay a dividend.

An important point, which, as the author remarks, has hardly been sufficiently appreciated, is the levelling of the percentage between indirect and direct wages for different classes of work as contrasted with pre-war conditions. In repetition work the ratio has fallen from 200 to 133, but in miscellaneous work, such as most of our larger engineering factories are concerned with, the ratio has risen from 75 to 112. This must have a most serious effect upon the prices that British firms are

able to quote for electrical plant, for instance. Further, since the capital cost of manufacturing plant has about trebled, and rates of interest on borrowed money have about doubled, the amount of interest payable in respect of a machine has gone up in the ratio of something like one to six.

It is clear, as we have pointed out in these columns on numerous occasions, that overhead charges fall as the number of articles made increases. In other words, total costs are reduced as the load factor is increased. If output is doubled, however, it is too much to expect that running charges (other than direct labour) will remain absolutely constant, and Mr. Pearson makes the interesting deduction that running charges vary as the square root of the direct wages. This is modified by his observation that where a new department is in process of development a straight-line relationship exists between running charges and direct wages until the supply of standard accessories and stock becomes established.

Tables are given which show most clearly the difference that is made to profits by even a small falling-off in output. We have emphasised over and over again the fact that production means profit, and ca' canny, whoever practises it, means scarcity, dearness, loss, and dissatisfaction all round; and those who still have any lingering belief in the amount of work there is to go round being a finite quantity, which must be spread over the whole field of the workers, will do well to consider the matter in the light that Mr. Pearson sheds upon it. An enormous increase on the amount of the pre-war net output is required to produce the same percentage of profit, and this means that the capital locked up in work in progress has been correspondingly multiplied—a fact which is causing disquiet to even the largest and wealthiest industrial concerns at the present time.

The timely warning is given that the management must avoid becoming enslaved by some elaborate costing system, and that intelligent use should be made of the figures and results obtained. It is evident, however, that manufacturing costs must be reduced if the British nation is to continue in the forefront of industrial progress; and while we are of the opinion that there will have to be some fall in wages, we believe that increased intensity of effort is required from all. It has frequently been stated that this has notably diminished since the introduction of the shorter week, and instanced therefore as an example of the perfidy of labour, who promised that output should not suffer for that reason. We know, however, of cases where it has been definitely established that the production per man per hour is greater now than at any previous time, and we believe that with the keener competition that must henceforth exist in the labour as well as all other markets, the necessity for everyone to put his best foot foremost will be generally realised. Some are inclined to say that there are to be found, even now, in the middle of the coal stoppage, signs of revival in trade. We doubt this, although it is remarkable to see what a tremendous amount of business awaits more settled conditions, and nothing else, before it can be placed. The demand is there, as we have said before, and buyers are just holding off until prices have fallen, or have shown unmistakable signs of having hardened. Which of these two things will happen it is hardly possible to say. Conditions are far too unstable for prophecy to be safe. We still continue to pay income tax at the rate of 6s. in the pound in order to pay ourselves interest at the rate of £5 14s. per cent. A lot of time and patience will be required from us all before things settle down, but two things are certain. One is that the needs of the world are far from being satisfied. The other is, that that nation will gain the most, not materially only, but spiritually too, whose members work hardest and most intelligently with their brains and with their hands; are not afraid to give a little more than they get; and are prepared to carry into practice the good old copy-book maxims relating to patience and industry.

The Electricity Supply Bill.

In view of the strong opposition that is being organised to the Electricity (Supply) Bill in Parliament and in the lay Press, it is evident that the passage of the Bill will be far from peaceful; in fact, as the Government is chary of promoting contentious legislation, it may be doubted whether this Bill, which represents the third attempt to make good the deficiencies of the Act of 1919, will stand any chance of passing into law during the current session. Its failure to do so would undoubtedly be a calamity to the electrical industry.

One of the arguments advanced against the Bill is that it involves a nationalisation or "semi-nationalisation" of the electricity supply industry. If that allegation had a solid basis, it would obviously be applicable to the principal Act, and not to the Bill, which merely provides for the execution of the principles that were embodied in the Act. Again, it is urged that it introduces a "hybrid" form of nationalisation that is unprecedented. This is not true, even with regard to this country; moreover, the essential characteristics of the "Joint Authority" scheme are to be found in active operation in France and Germany, where the system of industrial and financial collaboration of municipalities and companies under State control has been in successful operation for years. A more dangerous charge, under the existing conditions, is that it constitutes an attempt to legalise the pledging of the rates on behalf of speculative trading; this argument requires some hardihood to put forward at this date. By the Act of 1882 authority was given to pledge the rates for the purpose of trading in electricity supply, which was at that time a vastly more speculative business than it is now. It has, in fact, ceased to be speculative; the business is there, without a doubt; customers are waiting metaphorically in queues for electricity, and to talk about it as "speculative" is pure nonsense—especially as those who raise that cry are quite willing to take up the "speculation." The position is quite plain: the ratepayers, backed by the Government, have long supported the policy of trading in electricity; they are now faced with the urgent necessity of developing that business as it ought to be developed, and if they refuse that responsibility, the alternative is for them to stand aside and let the concessions be granted to companies. We believe that this would be the best outcome in the public interest; but we cannot endure to hear the companies hypocritically denounce the Bill on the ground of "speculative trading" whilst they are hoping to secure the trade themselves. Attempts are being made to confuse the issues, and to represent that companies and municipalities are in the same boat; that co-operation is all that is necessary to fulfil the purposes of the 1919 Act, without Joint Authorities, and above all, without the Bill—but we have seen what the co-operative spirit amounts to, and it is evident that nothing effective will be done without this Bill, except in certain districts.

It is clear that the purpose of the opponents of the Bill is to wreck it, and with it the whole scheme of Joint Authorities; they wish to leave nothing of the 1919 Act but the Electricity Commissioners with power to make recommendations and draw up reports—in a word, the "nerveless figurehead" to which we have previously referred.

It is alleged that the local rates may be involved to the tune of 50 millions sterling. This is a gross misstatement; in the first place, a still greater expenditure on the security of the rates will be necessary if the local authorities are left to provide the extensions which are so urgently needed, and which they are bound to make in order to meet their statutory obligations; and in the second place, the demand for increased supply is already in existence and clamouring to be satisfied—there is nothing speculative about the business, and there is no

reason to anticipate any call upon the rates at all. To suggest that "£50,000,000 may go on local rates"—the words used by the *Daily Mail*—is worse than disingenuous; it is false, for the reference is to capital outlay, but it is made to appear that the sum named would have to be met out of the rates. It has even been stated in a financial paper that the omission of the financial clauses proves that the Act of 1919 was a "hasty, hotch-potch measure," whereas it was examined with minute care by a Committee of the House of Commons over a period of months.

There is some truth, however, in the suggestion that the municipalities may refuse to accept the financial responsibility imposed upon them, if we may judge by recent indications. If so, they will have only themselves to blame if the supply industry passes from their hands. They welcomed the complete Bill of 1919 with open arms, and would have had it made even more oppressive to the companies by denying them representation on the Joint Authorities. If they now reject the financial clauses, they stultify their previous attitude and throw the whole business into the hands of the companies—for the Government will unquestionably decline to shoulder the burden, a blessing for which we are truly thankful. State control is inevitable, and may well be salutary; but State ownership and operation is synonymous with economic disaster and technical stagnation.

The case of London is unique, in that it is impossible to solve the problem of its electricity supply without the necessary financial powers. Schemes have been submitted to the Electricity Commissioners by various parties to which these powers are indispensable, and unless they are granted, the inquiry which is shortly to be held, and which is sure to be protracted and expensive, will be a waste of time and money. The reform of London's electricity supply depends on the passing of the Bill. The only alternative is the purchase of the undertakings concerned by the London County Council when the time matures, and in the meantime the industry will languish and London will be handicapped.

Further capital outlay is inevitable in all the industrial areas, and is urgently necessary; the Joint Authorities will decide how it can be expended to the best advantage, and they will act at every step under the control of the Commissioners and of Parliament, whose sanction is necessary to every scheme. Hence it is absurd to speak of the expenditure as "uncontrolled."

In dealing with these great questions, all political considerations should be excluded; the matter in each case should be settled on sound engineering and economic lines, and the Commissioners have shown, in the case of the North Wales district, that it is their intention to carry out this policy.

It is true that the Bill is capable of amendment, and one of the most important directions in which improvement is called for is in connection with the system of charging for electrical energy. At present it is obligatory to offer a flat rate per kilowatt-hour, a system which has repeatedly been shown to be unsuitable to the existing conditions, and the subject has recently been fully discussed by the Institution of Electrical Engineers. All parties are agreed that a multipart tariff is essential, without the short-circuit of a flat rate, and it is to be hoped that steps will be taken to provide in the Bill the necessary authority to charge on this basis.

In conclusion, we earnestly hope that the Bill will shortly become law. We have no fear that it will be used to prejudice the interests of the companies, which cannot be dispossessed or bought out compulsorily so long as they carry out their obligations. We anticipate that, where companies possessing the necessary powers exist, the Commissioners will entrust to them a due share of the work of electricity supply, and that in all their actions they will keep in view the prime necessity of a cheap and abundant supply of electrical energy throughout the whole country.

Are We Downhearted?

Does Mr. Walter Runciman, formerly President of the Board of Trade, and now President of the Association of Trade Protection Societies of the United Kingdom, imagine that he is going to do any good by prophesying that Britain will not regain her position in the world within a period of ten years? We have little faith in prophets who hazard guesses of this kind. When the war was at its height there were always some to say that it would be "all over by Christmas," and their optimism was as useless as was the gloom of the pessimist who foretold a struggle of long duration, and consoled us with the assertion that "the first seven years of a war were the worst." And we are as little inclined to-day to pay serious heed to those who predict a rapid fall in the cost of living, almost countless points in a few months, as we are to place the slightest confidence in those who gloomily predict a long-drawn-out continuance of our present adversity, and affect to possess some exceptional means of fixing the date when we shall once again—if ever—be on the flood tide of prosperity.

The situation, of course, is bad, everybody ought to know that it is so, but we shall only make things worse than they are, or than they need be, by uttering forecasts which add to depression of spirit, and suggest that there is plenty of time to spare before enterprising men can proceed to repair the breaches in the wall. Sir Arthur Steel Maitland, formerly of the Overseas Trade Department and subsequently associated with the Federation of British Industries, has just returned from a journey to South America and other countries, where he has been considering the possibilities of British trade. We have not yet taken advantage of the opportunities that were ours at the close of the war, but Sir Arthur says: "The chance, however, is still ours," though naturally it will grow less week by week and day by day. He writes a letter to *The Times* (May 14th), which we consider a very useful addition to the discussion on the coal controversy which is at the moment the chief obstacle in the way of our taking advantage of the export trade opportunity that still remains open to us.

If Mr. Runciman were chairman of an electrical manufacturing or engineering company instead of being personally more intimate with coal and shipping matters, he might take a different view of some sections of our national trade. While the coal struggle is in progress its consequences are adding considerably to the number of the electrical and engineering unemployed, but that is not because there is not work for them to do. Many of our manufacturers have plenty of business in hand, and there is plenty more to follow when confidence is restored and financial stringency is relieved. We believe that the placing of many millions of pounds' worth of electrical and allied contracts cannot be long deferred, and the healthy activity of the electrical industry will have a direct and indirect effect of an exhilarating kind upon other industries. The natural and inherent possibilities of electricity acting simultaneously both as the pioneer and as the servant of mankind are so great that every electrical man ought to be an optimist. Unfortunately, however, we cannot escape the consequences of the narrowness and folly of the extremist, the striker, the slacker, and the wrong-doer, who hinder the progress of the trade upon which their daily bread depends. If only we could secure the cordial co-operation of employers and employed in seeking the full development of the electrical industry in the interests of all, there would be little need for fear, and no need for gloomy prophecy. Would to Heaven that we would all settle down to our own particular tasks in the great work of setting the electrical industrial house in order instead of busying ourselves with clamouring for our individual rights, regardless of the best interests of the whole!

THE ROYAL SOCIETY'S SOIRÉE.

On Wednesday evening, last week, a representative gathering of Fellows and guests of the Royal Society assembled at Burlington House, Piccadilly, being received by Prof. Charles Sherrington, M.A., M.D., president, on the occasion of the first of the two annual conversaziones that are held by the Society. As usual main interest centred on the exhibits, and demonstrations constantly attracted attention during the evening; one noticed, however, nothing very novel of an electrical character.

One of the most interesting exhibits was the latest improved pattern of cloud expansion apparatus by means of which the tracks of α and β rays and X-rays were continually demonstrated. It will be remembered that Mr. C. T. R. Wilson described his original cloud expansion apparatus, as used for this purpose, before the Royal Society in April, 1911, and at that time the Cambridge Scientific Instrument Co. undertook the production of the device. The manufacture, however, of this class of apparatus was entirely stopped by the war.

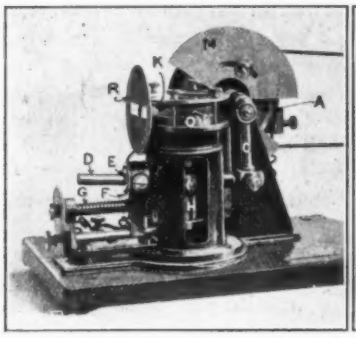


Fig. 1.

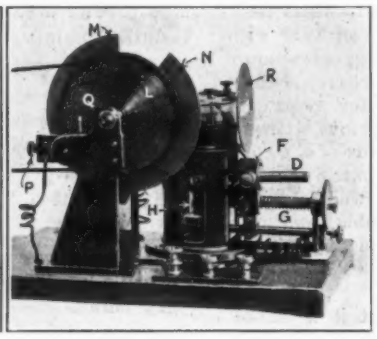


Fig. 2.

Cloud Expansion Apparatus.

Lately Mr. Takeo Shimizu, of Japan, while working at the Cavendish Laboratory, Cambridge, considerably modified Mr. Wilson's original apparatus, and the Cambridge & Paul Instrument Co., Ltd., is now putting the improved design upon the market. In Mr. Wilson's original apparatus only a single expansion was obtained, and it was thought to be necessary to give a comparatively rapid expansion in the working chamber, which was obtained by connecting the space under the moving piston to another space which was previously evacuated; the moving piston was, in consequence, suddenly sucked down against a rubber stop. Mr. Shimizu found, however, that sudden expansion was not necessary, and he, therefore, arranged a reciprocating piston by means of which he obtains cloud tracks of the rays at each expansion which may be timed to occur at rates of from about 50 to 200 per minute. The instrument thus designed is extremely simple, but there are several important points to which attention must be given for successful operation.

In fig. 1 A is the crank which is driven either by a hand-wheel or by means of a small motor. This crank drives the upright connecting rod C which, in turn, drives the horizontal connecting rod D; the far end of D slides in a sleeve E and is free to rock in F, which can be adjusted in a horizontal direction by means of the screw G. The piston rod H is connected near the middle of this latter connecting rod, and it will be seen, therefore, that as the crank A is a constant length, the horizontal adjustment of F alters the length of the stroke given to the piston rod H. By this means the expansion ratio at each stroke in the working chamber K can be adjusted while the instrument is in operation.

Now, in order to obtain a good picture of the rays which become visible at each expansion by the formation of linear clouds on the ionised particles in the ray tracks, it is necessary that the clouds be dissipated during the compression stroke. This is done by forming a vertical electrostatic field in the expansion chamber. The upper glass plate of the expansion chamber through which the tracks are observed or photographed is covered on the inside with a gelatine film which is made conducting, and this film is charged negatively with reference to the metal piston, but by means of the commutator L (see fig. 2) which rotates with the crank A, the plate is discharged just before the occurrence of the cloud formation. In the same way as the expansion ratio can be adjusted while the instrument is running, so the length of the period during which the electric field is cut off can also be adjusted while the instrument is functioning by means of the screw P, which traverses the contact bush Q along the commutator L, which is shaped (as will clearly be seen in fig. 2) in the manner required to give this adjustment. Also rotating with the crank A are two adjustable lead segments M and N, which can be used as shutters for admitting X-rays to the expansion chamber at the proper intervals. It is on the back of the disk carrying these segments that the above-described commutator L is fitted. The expansion chamber is provided with a small tube O by means of which radioactive matter can be introduced into the chamber for the production of α or β rays. The present chamber is made 55 mm. in diameter, which is, of course, less than the length of the tracks of some of the α rays in air, but the velocity of the α rays can be reduced by passing them through a mica screen. A small screen can also be placed on the piston to cut off the α rays, except at the moment of greatest expansion.

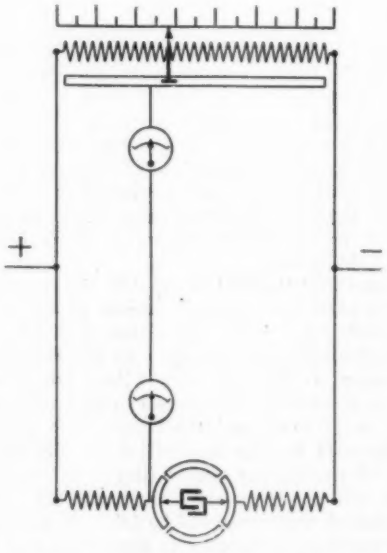


Fig. 3.—Diagram showing Principle of Pulsator Speed Telegraph.

The expansion chamber must be perfectly air-tight, as the minutest leak produces eddy currents which at once destroy the tracks.

The instrument is very quickly set up and easily operated, as a few expansions serve to filter out any dust originally in the air. The piston forming the floor of the expansion chamber is covered with a comparatively thick layer of gelatine containing about 10

per cent. of Indian ink. This gives a good black background against which the tracks show up brilliantly. For demonstration purposes a Pointolite lamp gives excellent results, but for photography a rather more brilliant lamp is desirable. Looking at fig. 1 the apparatus is seen as illuminated by means of a parallel beam of light coming from the left-hand side. The screen B cuts off all light except a small rectangular pencil passing through the middle of the expansion chamber.

Mr. Shimizu has taken many stereoscopic pictures on kinematograph films with his original apparatus, and by means of these stereoscopic pictures the exact paths

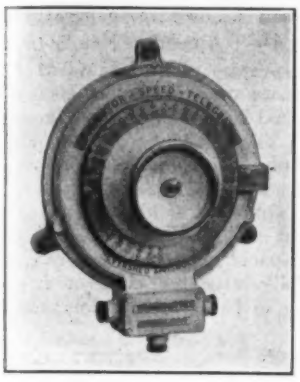


Fig. 4.—Transmitter or Speed Meter.

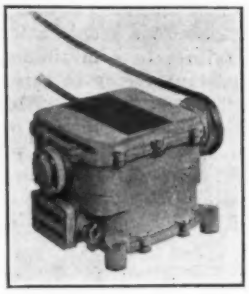


Fig. 5.—Chain-driven Pulsator.

of the particles in space can be calculated. The Cambridge & Paul Instrument Co., Ltd., hopes shortly to bring out a suitable stereoscopic camera as an accessory.

Needham's pulsator system of speed measurement and control was shown in operation by Messrs. Evershed & Vignoles, Ltd. It provides a sensitive electrical means of measuring speed, and may be employed as a speed telegraph of novel and extremely trustworthy character. In addition to signalling from one or a number of control positions, measurements may be

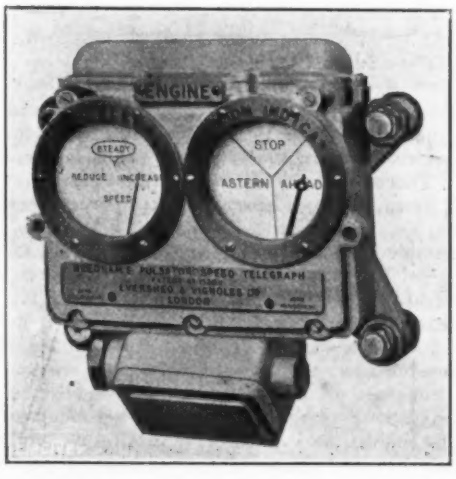


Fig. 6.—Combined Balance and Direction Indicator.

effected simultaneously and independently at a number of positions, so that the system is one of great flexibility; it also indicates the direction of rotation of the machinery, and provides an absolutely automatic relay by which it may be ascertained if an order to the engine room has been obeyed. The system is extremely suitable for use on ships, in power houses, and other places where a measurement or an indication of speed is desired at a distance from the moving machinery.

The system depends for the constancy of its indications on the capacity of an electrical condenser and on the value of an ordinary non-inductive resistance. The method of working is analogous in electrical principle to the operation of balancing a Wheatstone bridge and it, therefore, gives great accuracy and has a very large range. The diagram, fig. 3, shows the principle on which the device operates.

The action of the system is quite independent of voltage variation in the d.c. supply from which it is operated, and the apparatus may consequently be run from a ship's electric lighting circuit or any other convenient source of supply. The current taken is less than a quarter of an ampere for each transmitting or measuring position on a 220-volt circuit, while at 100 volts the current is halved.

The reply which the device provides when employed as a speed telegraph is automatic, and when the apparatus is in operation it is absolutely impossible to indicate

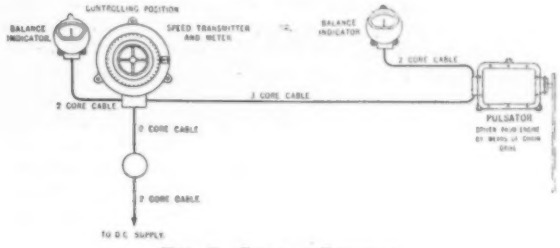


Fig. 7.—Lay-out Diagram.

that an order has been obeyed unless the apparatus under control is actually running at the speed which has been signalled to it.

The essential instruments of the system comprise a rheostat, fig. 4, serving either as a speed transmitter or speed meter, or both; a "Pulsator," fig. 5, driven by the engine or other apparatus, the speed of which is to be controlled or measured; and balance indicators which show when the pulsator is revolving at a speed corresponding to the position of a contactor in the rheostat. The speed transmitter and meter is mounted at the position from which control is to be effected which, in the case of a ship, would be generally on the bridge. One of the balance indicators is mounted in the engine room in a convenient position; the other, fig. 6, is mounted close to the transmitter or meter. The whole system is connected together by means of suitable cables, and is supplied from any available d.c. supply.

The diagram, fig. 7, shows the lay-out in the case of a simple installation capable of measuring and for controlling at one position the speed of an engine or other apparatus at a distance, but the arrangement shown does not indicate in any way the limit of the possibilities of the system. Arrangements can be made to suit cases in which a large number of alternative control or measuring positions is required, and the system can also be arranged to indicate or signal the direction of rotation of the engine or other apparatus.

The method of using the apparatus is as follows:—For controlling, the transmitter is set to the desired speed when, if the engine is not running at this speed, the pointers of the balance indicators will deflect to either "reduce" or to "increase" speed, depending on the nature of the order. The engineer must alter the speed of the engine accordingly until the pointer of his indicator shows balance, when the indicator at the control station will also show balance, and the operator will know that the order is obeyed. To measure speed, the dial of the meter is moved until the indicator is balanced. The speed can then be read off the dial of the meter against the fixed fiducial mark or pointer.

(To be concluded.)

OBSCURE DEFECTS IN HOUSE FITTINGS AND SOME UNUSUAL REMEDIES.

By "VOLTMAN."

The electrical troubles of the ordinary householder with regard to his lighting fittings generally prove on investigation to be what might be termed "obscure but minor faults." They are the little things that one would least suspect, and if one could go straight to them, one would save time, worry, and expense. When one gets a reputation amongst one's acquaintances as a dabbler in the electric arts one is liable to get all sorts of queer commissions to investigate faults which have nonplussed the local self-styled "electrician," who, one imagines, is really more in his element amongst gramophones and cycle accessories than in scenting out an elusive bad contact or using a galvanometer or test set.

One rather interesting case of the kind the writer investigated some little time ago. The centre light over a friend's billiard table was definitely "out," and holding up play. The local man had been called in, and as might be expected promptly diagnosed the trouble as a burnt-out lamp, but as a new lamp failed to function, the matter was held over to examine the fittings, and if need be re-wire them. The fuse on the three lights had meanwhile been found to be intact. Actually the fault proved to be a ludicrously simple one. At the suggestion of the writer it was decided to unscrew the cover of the ceiling rose. The cable ends, where they came through the terminals to which the flexible was connected, were found to be very much "alive." The terminal screws were tight up, and apparently firmly gripping the wires, but that was precisely the trouble; they were not long enough to grip, and both cable ends were, in fact, quite loose in the terminals. Luckily a small bit of the wire had been brought through the terminals and bent back. These ends were pushed into the terminals with the point of a penknife blade, and sufficient metal obtained to enable the screws to get a firm grip, and contact was restored. Thus the local man with his bag of tools and coil of cable was done out of a job.

Another house lighting problem which had proved a mystery to the household concerned was the case of a hall lamp which frequently switched itself on. How much current had been wasted was never known, but it is certain that the lamp used to be alight in the daytime continuously for hours. Again the solution of the mystery proved ridiculously simple. Inquiry indicated that when the light had been found "on" the switch seemed to be but partly "on," and only required a mere touch to put it "off." A glance inside the switch showed at once what was wrong. The throw-off spring had broken, and the contact arm was quite loose and had no positive off action. The application of Sherlock Holmes's methods of deduction infallibly showed that anyone putting on an overcoat or even brushing past would probably lightly and unconsciously touch the switch knob and close the circuit. An efficient substitute for a new spring was soon found by cutting a bit of rubber from an old motor tire tube. This was packed under the contact arm and provided ample tension. The "repair" has stood for three years, and may last indefinitely.

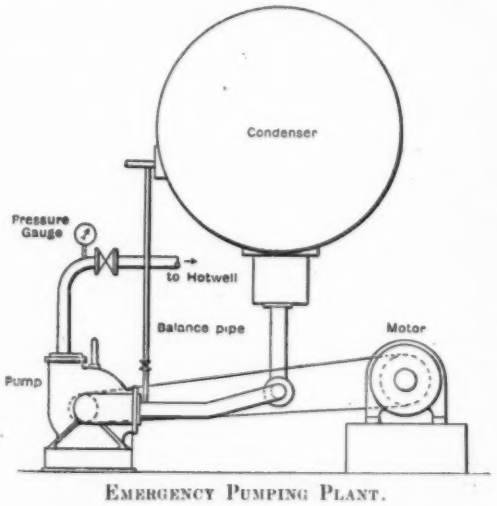
Obscure faults in lampholders are another source of worry to the non-technical householder. Here, again, it is nearly always a bad contact that causes trouble. The writer has "faked" two or three cases where lamps would aggravatingly light sometimes and not at other times, due to one or both of the spring plungers in the holder sticking. Arcing takes place and, of course, good contact soon disappears. A quite practical dodge of the writer's in such cases is to put a touch of solder on the lamp contacts so that firmer pressure is obtained against the plungers, which generally have a little "spring" left, but not much.

New lamps, owing, it would seem, to incorrect fitting of the cap, not infrequently fail to make contact even when the holder is in perfectly good order. The touch of solder treatment on the contact plates will quickly put this defect right and enable the lamp to be used.

AN EMERGENCY EXTRACTION PUMP FOR A CONDENSER.

By W. N. Y. KING, A.C.G.I., A.M.I.E.E.

The reliability of the steam turbine has been so proved that a supply of power can be depended on continuously for commercial purposes from two or three generating sets. Sometimes one set only is considered sufficient equipment to rely on for a private plant. In view of the fact that several such plants are in operation, many engineers are keenly interested in reducing any chance of failure to a minimum. The auxiliary plant is an important factor in this connection, principally as regards the condenser. While a steam turbine can operate successfully exhausting to atmosphere when the condenser fails, the boiler plant may, and very probably will, not have sufficient capacity to meet the extra demand for steam; especially with the class of fuel which has been and is likely to be obtainable for some



Emergency Pumping Plant.

time now. It may happen, then, that the full load cannot be maintained for long, and in addition the cost of the extra steam required will be about 50 per cent. more. Therefore, in case of a failure involving the closing down of a condenser, any temporary means of avoiding these consequences will prove a valuable asset. One example of this occurred in the case of a 1,500-kW turbine on the failure of a condensate extraction pump of the centrifugal type, running at 1,420 r.p.m. The pump cover was fractured and the vacuum gradually failed during a period of about 15 minutes, allowing time for another machine to be run up on load before turning on to atmosphere. There being no spare extraction pump, a temporary arrangement was made to enable the condenser to work by coupling a centrifugal water pump of the ordinary type to the condenser outlet, and driving it by means of a 20-h.p. motor and belt. The actual power required would have been met by a smaller motor, but the most readily available machine was made use of. The arrangement, illustrated in the accompanying sketch, proved thoroughly satisfactory, the whole condensate being dealt with, and full vacuum maintained, 28 in. to 29 in., in spite of the fact that the pump was of a different type to that designed for the purpose. Repairs to the fractured pump were then carried out at convenience.

JOINT ELECTRICITY AUTHORITIES.

(*Concluded from page* 634.)

London Electricity Joint Committee 1920 (Ltd.).

The London Electricity Joint Committee 1920, (Ltd.), in submitting a scheme for the constitution of a Joint Electricity Authority, does so under the following reservations:—

The Joint Committee is not satisfied that the district, as provisionally determined by the Electricity Commissioners, is the best and most economical that could be devised for the supply of the London area. This being the case, in adopting the technical scheme prepared by the Engineering Committee appointed by the London County Council, the local authorities and the Joint Committee,* it adopts it as the best scheme for the district so provisionally determined as a whole, and not necessarily the best scheme for an altered London area. In certain circumstances it might be necessary to modify the district provisionally delimited by the Commissioners, but any modificaton would depend upon the extent to which the local authority and company undertakers within the district were prepared to join in a scheme for the establishment of a Joint Electricity Authority and the extent of the area covered by the undertakings which might so join.

The chairman and vice-chairman shall be appointed by the authority, and may, but need not, be appointed members. The members of the authority shall be appointed by the: (*a*) London County Council, five; (*b*) City Corporation, one; authorised undertakers in the district, being local authorities, (*c*) whether they have entered into an agreement with the authority or not (one for every 100 million units sold by the whole of such authorised undertakers within the district during the year ending March 31st next preceding the appointment); (*d*) who have entered into an agreement as aforesaid (one for every 50 million units sold by the whole of such authorised undertakers within the district during the year ending March 31st next preceding the appointment); authorised undertakers in the district (not being local authorities), (*e*) whether they have entered into an agreement or not (one for every 100 million units sold by the whole of such authorised undertakers within the district during the year ending March 31st next preceding the appointment); (*f*) who have entered into an agreement as aforesaid (one for every 50 million units sold by the whole of such authorised undertakers within the district during the year ending March 31st next preceding the appointment); (*g*) local authorities of areas in the district outside the County of London, from whom any right to purchase any or part of an undertaking is transferred to the authority by this scheme, two; (*h*) railway companies and large consumers (*i.e.*, consuming not less than 250,000 units per annum), three.

Notwithstanding anything in the Act or in this scheme, the authority shall not afford any supply of electrical energy to any railway company during the continuance of any agreement in force on the appointed day for the supply of electrical energy to such railway company by any authorised undertaker without the consent of such authorised undertaker. Agreements to transfer to the Authority generating stations and main transmission lines of authorised undertakers within the district shall not apply to any part of the undertaking of the Metropolitan Electric Supply Co., Ltd., which is outside the County of London, and is not subject to any right of purchase by a local authority.

It shall not be obligatory on the Authority to supply electricity to any authorised undertakers who have not agreed to transfer to the Authority their generating stations and main transmission lines within the district.

With regard to the financial proposals, as the law now stands the Authority could presumably borrow money for the purposes of carrying out the scheme on the security of its undertaking, but further capital powers seem open to doubt.

The remaining two schemes, submitted by the London County Council and the Conference of Local Authorities Owning Electricity Undertakings in Greater London respectively, have already been outlined in our pages (see Elec. Rev., Dec. 10th, 1920, p. 744; Mar. 18th, 1921, p. 363; and Feb. 11th, 1921, p. 169).

The Kent Electricity Area.

At a meeting at Gwydyr House (London headquarters of the Electricity Commission) in July, 1920, a committee consisting of the following gentlemen: Messrs. E. O. Forster Brown, E. E. Hoadley (Maidstone Corporation), H. B. Harvey (Kent Electric Power Co., Chatham), J. A. Forde (Isle of Thanet Electric Tramways & Lighting Co., Ltd., Broadstairs), A. Raworth, and Thomas Hesketh, acting secretary (Folkestone Electricity Supply Co., Ltd.), was appointed to survey the present position and potential requirements of electricity supply in the County of Kent (exclusive of the London area), and to recommend a general policy of development. The committee's report, which is dated November, 1920, has just been submitted to the Electricity Commissioners, and what follows is an abstract of it.

Present Position.—The bulk of the existing demand for and supply of electricity in the district under consideration (see fig. 1; the diameters of the circles are proportional to the electricity demands) are broadly for manufacturing purposes in the western area and for lighting and colliery purposes in the eastern area; while in the central area, which is mainly confined to agriculture, electrical developments are practically non-existent. The western manufacturing area may be defined as that lying approximately to the north-west of a line drawn through Tunbridge Wells, Maidstone, Sittingbourne and the coast. The eastern area lies approximately east of a line drawn a little west of Whitstable, Canterbury, and Folkestone. The only generating plant of which the committee is aware in the central and agricultural area is one of 500 kW at Ashford, belonging to the South-Eastern & Chatham Railway, and one of 250 kW at Faversham.

The demand for electricity for manufacturing purposes in the western area is a very rapidly increasing one, whereas in the eastern area the lighting demand is increasing at a more normal rate. It should be emphasised that in neither area has the development of electricity supply attained proportions in any way comparable with the more highly industrialised districts of Great Britain. The existing position of affairs in the eastern area, however, is likely to be entirely altered as the existing colliery undertakings in the south-east Kent coalfield become fully developed, and when new collieries are sunk in the undeveloped portion of the coalfield. The development of this field, and the effect is will have in creating conditions for the generation of electricity on a large scale at a relatively low cost, will eventually therefore convert an essentially lighting area into an intensified industrial one.

Another important factor which may in the future influence the scope and direction of electrical development is the electrification of the South-Eastern & Chatham Railway. The materialisation of this project might influence general electrical development not only in the western and eastern areas, but also in the intervening agricultural area; altogether apart

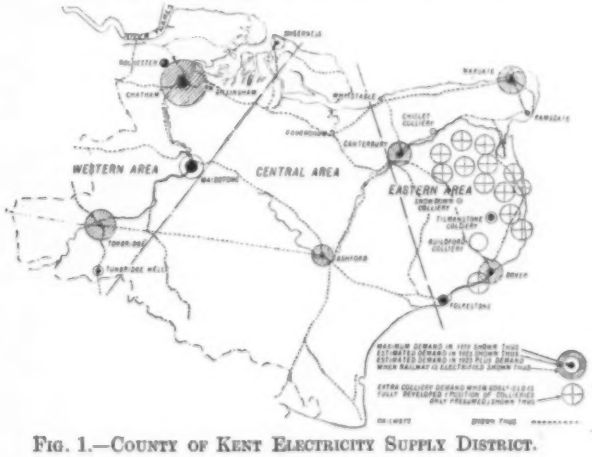


Fig. 1.—County of Kent Electricity Supply District.

from the possible construction, at some future date, of the Channel Tunnel.

The existing arrangements are not adequate to deal with the future requirements of the district, which should be controlled by one Joint Electricity Authority, although in the first instance there will probably be two independent areas of supply, situate in east and west Kent respectively. As development matures, however, it may become desirable to link up these two areas and form one entity.

Western Area.—Up to the end of 1919, the actual demand on the stations of this area has been in the neighbourhood of 6,458 kW, whereas the demand for 1923 may approximate to 15,120 kW; when the S.E. & C. Railway has been electrified, however, the demand may reach 27,420 kW. The total generating plant in the area approximates to 15,725 kW, and the amount of 3-phase 50-cycle plant included in this figure totals approximately 12,220 kW, of which a considerable proportion is of modern efficiency.

Ignoring for the moment the financial side of the matter, it would appear desirable to consider whether as a preliminary step the Maidstone and Chatham generating stations should be linked up to form the nucleus of an interlinking system for the western area, which might gradually be developed from this basis.

Eastern Area.—The major portion of the electricity in this area will probably in the future be consumed at the collieries and generated by means of coal produced from them. Even at the present incipient stage of development of the coalfield, the generating plant installed or provided for at the various collieries furnishes an important percentage of the total generating plant in the district.

Apart from financial considerations, a preliminary survey indicates that considerable benefits might accrue if the four existing collieries were linked up, and also connected with some of the more important towns in their vicinity, such as Dover, Canterbury, and Folkestone. The effect of this linking up, with the benefits of improved load factor and increased stand-by plant to which it would give rise, would probably

* Electrical Review, Mar. 18th, 1921, p. 363; Dec. 10th, 1920, p. 744.

go a long way towards meeting any increased demand, not only from the existing collieries, but also from the towns interlinked with them, for some time to come.

The conditions of electricity supply in the final stage of the development of the coalfield would be entirely different. During this stage it is anticipated that a considerable proportion of the output of the coalfield would be made into coke and employed in conjunction with iron and steel works on the spot. This development would give rise to various secondary products of coal such as waste heat, waste gas, coke breeze, and washery sludge, produced in large quantities in the neighbourhood of tidal waters which could be utilised for condensing purposes. By these means electricity could be produced on a large scale at a relatively low cost. The ultimate peak load of all the collieries may then amount to 50,000 kW; and in addition the accessory works, towns, and factories connected with the system would have to be provided for.

Electrification of S.E. & C. Railway.—The S.E. & C. Railway has a scheme prepared for the electrification of the lines to Chatham and Tonbridge, and the committee believes that, in the not far future, electrical operation of the main and Kent coast lines will be considered. The load factor of the railway demand will be excellent, and there is no doubt that if it is found practicable to supply both the railway and other demands from the same source, the advantages to the community will be considerable.

There are, however, certain difficulties in the way of attainment of this admittedly desirable arrangement which have been pointed out by Mr. Raworth, namely, that "the whole of the modern three-phase plant at present existing within the district is designed for the generation of energy at 50 cycles. If rotary converters are used, owing to the impossibility of obtaining a 50-cycle machine to produce d.c. at 1,500 volts, it will be necessary to employ 750-volt machines arranged in pairs and connected in series, an obviously costly and complicated arrangement. In this connection evidence is available which appears to justify the following conclusions: (1) That the cost of d.c. at 1,500 volts, if obtained through 50-cycle motor generators, would be some 15 per cent. higher than if obtained through 25-cycle rotary converters. (2) That 50-cycle rotary converters are not sufficiently reliable for railway operating purposes."

Finance.—The Committee emphasises the fact that finance is the dominating factor. Before any scheme is entered upon it will be necessary to know where the money is coming from, and upon that information it will be provided, and in the absence of that information the committee did not feel justified in attempting to do more than indicate the general lines upon which development might proceed.

Conclusions.—Summarised, the conclusions arrived at are as follows: (1) The district under review is at present inadequately supplied with electricity, and insufficiently organised in view of modern developments. That there is an urgent call for some form of control to be set up to supervise and mould the individual undertakings into a well organised whole, in order that full advantage may be taken of future developments. (2) To enable this to be done a Joint Electricity Authority should be set up forthwith for the district. (3) To commence with, the district should be divided into two main supply areas, viz., the western area and the eastern area, with the ultimate aim in view of their becoming interlinked and forming one complete whole as far as transmission is concerned. (4) The most promising line of development at the present moment would take the form of interlinking the best of the three-phase stations. (5) If any organisation is to be set up to deal with the matter, it is important it should be formed at an early date, and (6) it should be left to the Joint Electricity Authority to decide upon what periodicity the district as a whole should ultimately be developed.

An appendix to the report contains, amongst others, the following figures:—

	Western area.	Eastern area.	Collieries.	Private plant.	Totals.
Maximum demand, 1919, kW ..	= 6,453	4,755	1,495	935	13,791
Estimated demand, 1923, kW ..	= 13,120	7,200	7,500	2,870	30,690
Existing plant, kW	= 15,725	9,178	5,000	2,620	32,523
Existing 3-phase 50-cycle plant, kW	= 12,220	2,600	5,000	—	19 820
3-phase plant on order, kW ..	= —	3,250	5,000	?	8,250

The possible demand for the S.E. & C. Railway electrification may be in the western area 12,300 kW and in the eastern area 13,200 kW.

The Electricity Commissioners have not yet come to any decision on the contents of the report.

The Swedish Electric Works.—The report of the A. B. Elektraverken states that the general industrial depression affected the company's manufacturing branches in 1920. Moreover, German competition based upon exchange dumping hampered the company's activity. Restrictions in working had to be made on a large scale in the second half of the year, and the unfavourable results were also prejudiced by a lock-out and the introduction of the eight-hour day. The accounts show a loss of 311,000 kroner, as against net profits of 557,000 kroner in 1919, when no dividend was paid. After extinguishing the loss by the absorption of most of the balance of 318,000 kroner brought forward, the sum of 7,000 kroner was carried to the accounts for 1921.

MULTI-PART TARIFFS.

Memorandum for the Electricity Commission.

In November, 1920, the Electricity Commissioners received as a deputation the Joint Committee of the British Electrical Development Association (Inc.), which was appointed to deal with tariffs and methods of charging for electricity supply in relation to proposed legislation; they indicated their willingness to consider any further statement of the case presented by the Committee, and asked for examples showing the operation of tariffs of the class which the deputation had in mind.

As a result of further deliberations by the Committee the memorandum abstracted below was submitted to the Electricity Commissioners, together with examples of multi-part tariffs in practice, namely, that at Grimsby, the floor space system at Dundee, and the rateable value systems at Gloucester, Norwich and Ilford (London).

The main object of the deputation was to ask that it should be made lawful for the Commissioners to grant requests from electricity suppliers for powers to enforce, in any particular distribution area or part thereof and with regard to any class or classes of consumers, systems of charging for supply which should secure to the suppliers payments or subscriptions sufficient to recoup them for the expense of being "ready to supply" and, in addition to such subscriptions, to charge for the energy actually used by the consumers as metered or otherwise computed. In order to effect this object the following draft clause was submitted as suitable for insertion in the Electricity (Supply) (No. 2) Bill:—

"Notwithstanding anything contained in any Act or Order confirmed by or having the effect of an Act, *it shall be lawful* for any undertakers on the application of such undertakers for any private purposes and any public purposes other than the lighting of any street, to charge by any method approved by the Electricity Commissioners for any particular area or class of consumers and any such method may authorise a periodical charge in addition to or in lieu of a charge for the energy supplied to him."

The systems of charging contemplated are generally referred to as *two-part or multi-part tariffs*, and are already in fairly extensive use (by agreement with consumers) for power and also for business and domestic supplies.

The advantages of this method of charging are:—

(*a*) *To the Supplier.*—A guaranteed return from each consumer on account of the costs incurred in being ready to supply him, &c.; such return being secured irrespectively of the amount of electricity used and also if for any reason *no electricity is used.* The ability to offer to consumers electricity at an average rate per kWh which diminishes as the load factor increases and in diminishing may be made to follow closely the characteristic of the curve of the cost of supply in relation to load and other factors in any given undertaking; and a relief from the risk of energy being used from a lower rated circuit for purposes which are chargeable at a higher rate. In effect, a tariff with which, if suitable values are chosen for the fixed and running charges, encouragement is offered to the consumer to use appliances and methods which tend to increase the efficiency of generation and distribution (*i.e.*, to lower costs).

(*b*) *To the Consumer.*—A supply of energy for all purposes through one meter at a single rate per unit. The ability to use apparatus of any kind on any part or circuit of the installation, subject only to its capacity, and without regard to varying charges; simplification of wiring; and freedom to use standard and interchangeable plugs and sockets for all purposes, within limits of capacity. Reduced cost of accidental waste or occasional abnormal use. Some control over average rates payable, and ability to lower it by arranging the use of the supply so as to improve the conditions of the suppliers; and in the case of a small user, knowledge in advance of the principal item of the account for supply.

(*c*) *To the industry generally.*—Encouragement to extend the general use of electricity, increased demand for apparatus and installation work, and simplification of methods.

The consumer automatically secures the service on a falling curve of average price which, to a great extent, coincides with the falling curve of the cost of supply. Other public utilities charge for service on a similar basis, and as in the case of water supply and telephone service the most equitable arrangement lies in collecting annual amounts from the consumers in relation to the "rate of use" and, in addition, making some further charge based upon their actual use of the commodity or service in question. Charges can in this way be made equitable to all.

Minimum Charge.—Although large increases in the charge per kWh have been necessary in recent years, yet the small consumer has really secured an advantage, his expenditure upon "electricity service" being actually reduced in certain cases. Until recently the consumer was liable to pay a minimum charge, generally equivalent to 80 kWh per year at 8d. per kWh, or £2 13s. 4d. In connection with maximum-price revision this has been altered generally to 2 quarters × 15 kWh × maximum price; 2 quarters × 10 kWh × maximum price; or 50 kWh per year at, for example, 1s. per kWh=only £2 10s., so that a 50 per cent. increase on the rate per kWh results in the guaranteed minimum revenue from the consumer falling £2 10s./£2 13s. 4d.=about 6 per cent.

Presumably the object of reducing the minimum *number of kWh* to be used or paid for from 80 to 50 (37 per cent.) is to allow the consumer a concession in view of the increased efficiency of the modern lamp. The result is to benefit the small consumer who had become a source of loss (*i.e.*, expense to all the consumers as a body) before the change; it in no way helps the consumer whose use exceeds the minimum, and it renders the position of the supply undertaking more difficult.

In the multi-part tariffs under consideration, the annual fixed charge is in the nature of a minimum payment, but does not cover any supply of energy, and merely to increase the minimum charges at present in force would not meet the requirements so well, and would only accentuate the disadvantages always attaching to such minimum demands.

There is little doubt that unification schemes for large areas would lead the public to demand more uniformity of the charge than exists to-day, and to satisfy such a demand might conceivably lead to an increase in charges near the centres of generation for the benefit of the more remote parts of the districts. It is contended that, so far as concerns the domestic load at least, multi-part systems of charging would help to overcome this difficulty. Consumers could be made to understand that the rates of a fixed charge or annual subscription must vary considerably in relation to distance along the distributing lines, the density of local loading, &c., whilst the running rate per kWh could be made uniform or nearly so over the whole area.

The potential domestic demand in this country is very large indeed. Even at present, and with the main heating of the house carried out by means of raw fuel, the use of electricity for lighting, for cooking, for occasional heating, and for mechanical appliances in the house may well call for from ten to fifteen times as much electricity as the lighting only, say, 2,000 to 3,000 kWh per home per annum as a moderate estimate against 200 for lighting only.

"Cheap and abundant supplies of electricity" have been put forward as the working ideal for industry, and as one of the most essential features of future prosperity. Within limits the statement is correct; in the majority of businesses, however, the expenditure upon electricity for light, power, or even heat ranks amongst the smallest of their outgoings.

Many machines and labour-saving devices now in use could never have been invented but for the ability to employ electricity in operating them. For some purposes also the cost of the electrical energy employed is so small compared with the value of the article produced, or with the incidental savings secured, that any reduction in the charges for supply is of no particular moment.

So far as concerns the country as a whole, it would appear more urgent for the supplies of electricity to be "abundant," *i.e.*, obtainable everywhere, than to be "cheap," and they must become abundant (widely distributed) before they can become "cheap." The maintenance of the flat rate method of charging and the restriction of maximum prices is responsible for delay in extension and for the refusal of business in many districts. Complaints of inability to obtain electricity are at present more prevalent than complaints relating to the prices charged.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Wear of Rotary-Converter Slip Rings.

The machines to which I refer are of the following capacity: 500 kW, 240 volts, d.c., the a.c. supply being 6-phase, 40 cycles, and the speed 800 r.p.m.

On each slip ring there are three tapping points, and we have found that the parts of the rings near these points become apparently high, whilst the parts between become low. The brushes used are "Metite," and the metal of the ring is of a copper bronze colour. Lubrication is effected by an oil swab lightly touching each ring.

Is it possible that the metal of the ring is transferred to the brush and *vice versa*, depending on the direction of the current, which will clearly go through three complete cycles during each revolution?

We find that an average run of 2,000 hours is about the maximum that can be obtained before a regrinding of the rings becomes necessary. Perhaps some other reader can elucidate this matter.

Kocaf.

May 11th, 1921.

Variable-speed a.c. Motors.

We are very much interested in the lecture by Dr. S. P. Smith, reported in your issue of May 6th, and although it is possibly not quite fair to criticise Dr. Smith in the absence of an absolutely complete report of his remarks, it would seem from your abstract as if he cannot be entirely acquitted of paying more attention to work done on the Continent than to that done in this country.

It is true he refers to Mr. Creedy's method of varying the speed of the polyphase induction motor, but he makes no reference to the variable single-phase commutator motor, developed by him, which has been on sale by us in this country for the past six years. These have been fully described in the Press on numerous occasions, and notably an abstract from a paper read before the Association of Supervising Electricians on April 9th, 1918, appeared in your columns and in the remainder of the technical Press.

We must all admire the work of Mr. Ll. B. Atkinson, but it is far from true that his conceptions have been developed not in this country but in Germany.

A very large number of these motors are running, some of which have been in operation for many years.

Pooley & Austin.

London.
May 10th, 1921.

The Grading of Mains Engineers.

It seems strange that no one has followed up the pertinent remarks of your correspondent "N. B." in your issue of April 22nd, for he really voices one of the anomalies of station work. Why should a mains superintendent get more pay than a charge engineer? One can answer that it is customary. But these are days when ancient customs are going by the board one after the other, and this particular custom will not really stand close analysis. The minimum necessary technical knowledge and practical experience are very considerably less to make a *passable* mains superintendent than a *passable* charge engineer. Against this must be set the fact that a mains superintendent is head of a department, and should have a certain amount more managerial and business responsibility, though in municipal stations this is not really a lot. On the other hand, the charge engineer has to possess certain physical and mental qualities in a considerably higher degree than the mains superintendent, and these qualities are probably rarer than the modicum of business ability set off against them. In close on 20 years of station experience I have come across over a dozen cases of men having to give up charge engineers' jobs because of the physical, mental, and nervous strain; yet the same men were almost invariably able to stand other branches of station work, and I cannot recall a single case of men in other positions having to seek a change. I can count up also a very large number of men with far less responsible positions in charge of running plant, from switchboard attendants to stokers, who were unable to "stick it," and it is recorded of the late Andrew Carnegie that as a youth he had a nervous collapse and had to give up his job through being put in charge of a boiler for heating a building.

If we take a hypothetical test case, I maintain that an intelligent clerk or layman, given a year's diligent work at a technical school and six months' practical experience, would make a better show as a mains superintendent than a similar man with two years' technical training and a year's practical experience would as a charge engineer, having the unrelieved responsibility for eight hours on end of engines, boilers, generators, switchboard, steam, and water auxiliaries, flues, fans, steam and water mains, &c.

I don't wish to detract from a mains superintendent's responsibilities; I have experienced the delights of turning out in a blinding storm at midnight with six inches of snow on the ground to try to locate a fault. I have also experienced considerable displays of fireworks on various switchboards, and honestly rather enjoyed the excitement of them as a rule. But a case of water hammer in a steam main at 4 a.m., a series of terrific unaccountable bangs that fairly shook the building, left me in a cold sweat for a month, as did also a breakdown of a pump (while the only other one was under repair) at the peak of a heavy load, with a bank of boilers all steaming their hardest.

But supposing, in deference to ancient custom, we concede the mains superintendent one grade above the charge engineer. By what freak of the maddest reasoning can we place him in the same grade as the station superintendent, as the E.P.E.A. schedule does? The station superintendent, whose necessary technical qualifications leave the mains superintendent in the infants' class! The station superintendent, who is responsible more than any man except the chief, for "producing cheaply," whose business abilities must be of a very high order to trace out the elusive B.th.n.'s through their many ramifications, and account for all of them!

The station superintendent and the charge engineers are really the key men of the electricity supply industry; without them any station will eventually stop; with them it can run almost indefinitely. Why, therefore, are they both so slighted in the E.P.E.A. schedule?—the one lumped in with the mains superintendent, and the other placed at the bottom of the list (for those grades from 8s to 10h are mere camouflage, no one is officially graded in them that I have been able to find out yet) with every Tom, Dick, and Harry in or about the station ranking with or over him! The explanation I have heard (I am open to correction on it) is that the schedule sub-committee was composed of three chief assistants and one mains man. 'Tis an ancient axiom of our race that "God helps those who help themselves," and that lonely but highly efficient representative of the mains department certainly got his ample fist well into the mess of pottage while it was being handed round.

I

It is a striking comment on the chastening effects of much shift work on the human system that, with the lonely exception of "N. B.," the charge engineers have accepted with humble and contrite hearts what the mains department has been pleased to give them.

P. S.

May 10th, 1921.

The Speed of Electric Motors as a National Problem.

The electric motor should be the prime mover for all industries, having the advantages of simplicity, safety, silence, and absence of offensive exhaust, among many others.

Electricity supply will become available in every part of the country when transmission is permitted with high-pressure overhead lines, as in Canada.

A large number of electric motors will be needed to make the factories they are required for efficient, whether placed in rural areas or in great and, too often, slummy towns. The capital required for these electric motors is a serious matter, and it is a clear proposition that, given the same durability, efficiency, and workmanship, the lowest first cost is the correct one.

The electric motor as a non-reciprocating prime mover is capable of rotating at high speed with no mechanical or electrical drawbacks; *vide* the generators of turbo sets.

Petrol-driven prime movers, with many delicate reciprocating parts, run at as high speed as the average electric motor, and in many cases at twice the speed.

The advertising pages of a leading mechanical engineering journal give the following machines that require driving: Pumps, cranes, fans, grinders, blowers, rolling mills, centrifugals, conveyors, mixers, lathes and machine tools, woodworking machinery, presses, vacuum plant, drills, out of which only one or two demand a low-speed mover.

Why then has the idea of low speed got standardised in the purchasing side of the electrical industry, and why does the electrical engineer of to-day permit his customer to specify low-speed machines?

The explanation often given is that the motor is to drive a line shaft, and this must not run above 160 r.p.m. Possibly the electrical engineer comes too late on the field to see that the shaft runs at 400 to 500 r.p.m., with corresponding saving in cost, weight, and maintenance.

Take wood-working machinery, where high-speed tools can alone secure perfect results; there are many instances where motors of 600 or 800 r.p.m. are being used to drive machines running at from 3,000 to 5,000 r.p.m., with intermediate shafts and corresponding want of efficiency.

The spread of polyphase supplies has tended to accustom buyers to speeds of the order of 1,500 to 1,800 r.p.m., even in large-sized motors, and that is to the good.

The object of this letter is to push forward the practical point that too much money is being laid out on low-speed motors to the detriment of the general purchasing power of electric motors and consequent spread of the demand for electric power which inevitably means more cables, switches, fuses, starters, conduit, electricity, work, and many other advantages to the electrical industry.

Justus Eck.

Southall.
May 16th, 1921.

The Maintenance of Intercommunication Telephones.

We noted with interest the letter of Mr. G. Theobald, of the B.E. Co., in your last issue. We have, since our company's formation, carried out work of this description, and we have no hesitation in saying that we have always given our clients every satisfaction. Any telephone installation overhauls which we undertake we always guarantee, and we also specialise in any complicated electrical systems not within the scope of the average electrical contractor.

We beg to state that our staff of expert telephone engineers is always at the service of all contractors—and Mr. Theobald.

W. E. Weekes & Co.
CHAS. H. CLARK.

London.
May 14th, 1921.

[To avoid confusion, we may mention that the initials "B.E. Co." here denote the Balding Electric Co.—EDS. ELEC. REV.]

The Wiring of Ferro-concrete Factories.

In my previous letter on this subject I said that as a result of considerable experience in wiring ferro-concrete factories, I had found the screwed steel conduit system to be the most suitable for this class of building. Opinions since aired on the subject seem to favour the C.T.S. cable system. In designing a ferro-concrete building I take it that everything that goes into its equipment should also be as nearly fireproof as the structure itself. In classifying wiring systems, I should certainly place only those having a non-combustible outer covering in the fireproof category.

In your current issue, Mr. A. C. Purday quotes me as saying that in Vancouver the only system recognised as coming up to the requirements of the modern fireproof building is the screwed steel conduit system. This is quite correct, and the City of Vancouver is exceptionally advanced electrically, and probably contains more buildings of this class than any city of a similar size in the British Empire.

Regarding ferro-concrete factories especially, the selection of the wiring installation depends largely upon whether the system is embedded in the concrete during building construction or run on the surface of the completed structure. Taking the former case as being more up to date, all the tedious cutting, chasing, and plugging of ceilings and walls, so common in English practice, is obviated.

I believe I am right in saying that there is no other concealed system of wiring that so lends itself to subsequent examination and repair as that of screwed steel conduit, it being possible to draw the wires out or in at any time without the slightest interference or damage to the finish of the building. Also with the additional protection of the concrete, it is as fireproof as it is possible to make electrical work, and will remain so as long as the building stands. In concluding, I may state that the Admiralty specifies screwed steel conduit wherever there is a particular danger from fire, and in addition uses it almost exclusively for the permanent general wiring throughout H.M. Dockyards.

P. Davis.

Portsmouth.
May 16th, 1921.

Cables for Hot Situations.

I should be very pleased to give "R. A. H." my idea of the ideal cable for use in situations where the temperature is normally 105 deg. F. and sometimes exceeds that value. I was recently wiring a rag-drying room, and not being aware of the amount of heat required for the drying process, in accordance with orders I carried out the job with V.I.R. cable in conduit.

Only 14 days elapsed before I was called in to replace fuses, which persisted in blowing; on making a strict inspection I discovered that the insulation was literally as dry as sticks, and in places had completely left the conductors. I was then confronted with the problem of finding a suitable class of cable which would withstand the heat. What was required was a cable the condition of the insulation of which could easily be ascertained, also which had a protective covering; the only cable which fulfils these conditions is C.T.S. Eventually I rewired the drying room with C.T.S., which I found stood up to the heat exceedingly well: one very good point about it is that, on examining the condition of the outer rubber sheathing, the condition of the inner insulation can easily be ascertained. I should be pleased to hear of any other cable which is suitable for high temperatures. Mechanically enclosed cables are, to my idea, retainers of heat.

Two Phase.

May 16th, 1921.

Conservative Methods.

Surely it is time that a strong protest was made against the perfectly idiotic method of packing accumulator plates adopted by certain well-known manufacturers. The plates are sent out immovably wedged into unbreakable crates by means of wooden distance pieces which nowhere project beyond the battery plates, and so are impossible to seize. Two strong battens are then jammed across the row of plates from side to side of the crate, to which they are fastened by huge nails driven through from the outside into their ends.

If these crates are as valuable as the makers would have us believe, why are they so packed that the average man concludes that nothing but force without stint will unpack them? If they are not really valuable, why is such a preposterous price put upon them? On my desk as I write is an account for over £50 for the cases of a small 50-volt battery.

Can anyone tell us of a maker who has heard of such mechanical aids as screws and bolts and nuts, and who uses them on his packing cases? I have orders waiting for that maker, but no more for the wild men of the nail age.

Twice Shy.

May 13th, 1921.

Electrical Dock Equipment.—A dry dock of the Tietjen and Lang Dry Docks Co., at Hoboken, New Jersey, which has been in operation since 1900, has been recently fitted with a complete system of electrically controlled pumps and motors. The dock consists of sections having a total overall length, including outriggers, of 468 ft. The new pumping equipment consists of ten 18-in. vertical-shaft single-bottom suction pumps. One of these pumps is placed in the centre compartment of each wing of each of the five sections; 12-in. cast-iron pipes are connected from the bottom of each pump and terminate at the two end compartments in the same section. Twelve-inch valves are installed in these lines, and the stems are extended to the decks of the wings. Eighteen-inch gate and check valves are placed in discharge lines. All suction lines are terminated by foot valves which bring the suctions to within 8 in. of the bottom of the dock. The electrical equipment consists of ten vertical squirrel-cage type 360 r.p.m. constant speed induction motors, designed for 75 h.p. capacity in 150-h.p. frames and for use on 2,400-volt, two-phase, 60 cycle alternating current circuits. The motors are coupled by means of flexible couplings to the shafts of the pumps.—*Journal of Commerce.*

THE TEMPERATURE LIMITS OF LARGE ALTERNATORS.

Discussion at Liverpool.

Members of the Liverpool Sub-Centre of the North-Western Centre of the Institution of Electrical Engineers, discussed Mr. G. A. Juhlin's paper on the above subject, which was abstracted in our issues of February 4th and 11th, on February 28th, when Mr. Hollingsworth remarked that in connection with electric generating plant, they should try and further any proposition leading towards reduced capital cost and increased efficiency, provided it was not at the sacrifice of reliability. That was the crux of the question; were they going to sacrifice anything in the direction of reliability by adopting the proposals put forward by the author? Experience with alternators had been generally satisfactory during recent years, and unless a very great advantage was to be obtained it was not advisable to make any great change in the design or construction of such plant. A machine the speaker had control of (one manufactured by Messrs. Dick Kerr, of Preston, and of which Mr. Juhlin was the designer) had been the cause of sleepless nights owing to a "hot spot" on the top of the yoke. It was not an easy matter to ascertain the correct temperature on such a surface, and the spot in question seemed to get hotter every time they felt it. Not to his knowledge had the machine in question given any trouble, and in all probability it was working at a higher temperature than that which Mr. Juhlin was now advocating such machines should be worked at. Engineers would not disagree with the author's plea for the adoption of temperature detectors, in fact manufacturers had been backward in that respect, for speaking as an operating engineer, he would have welcomed anything of the sort years ago. In the case of machines running at the same speed, "those with high temperature rating are cheaper," but would that mean any great decrease in capital cost? There would be a reduction in material, but the labour costs would not be reduced very much, and in any case would the reduced capital cost compensate for the reduced reliability? The speaker could not understand what Mr. Juhlin meant by "higher efficiencies are obtainable"; how did a decrease in copper mean increased efficiency? "Larger units can be built at higher speeds," but with their present knowledge of the steam turbine that was the limiting factor, and they could not deal with the alternators without taking the turbines into consideration. Mr. Juhlin was prepared to build alternators of considerably greater capacity than at present at a speed of 3,000 r.p.m., but the speaker said he would not like to install one of more than 8,000 kW at 3,000 r.p.m.; therefore, he did not see that any great claim could be made for higher alternator speeds until Mr. Juhlin could get some of his brother engineers to produce a reliable turbine.

Mr. F. J. Teago pointed out that the author proposed that the limit of the ultimate temperature, as measured on the conductors in the core, should be 160 deg. C. The existing rule was that, for mica, paper, and like materials, the limiting ultimate temperature should be 125 deg. C. The latter figure, then, would be measured on the end windings and not in the slots, since the insulation in the slots was practically pure mica. Now, in general, if the end windings were worked at a total temperature of 125 deg. C., the windings in the slots would be 160 deg. C. and perfectly safe, since micanite tubes would withstand temperatures far in excess of anything yet proposed. Since the end windings formed the weak spot, and since 125 deg. C. measured there would rate the machine as high as 160 deg. C. measured in the slots, why not use the end windings as the point of reference? The end windings also had the advantage of accessibility. In any case, Mr. Juhlin's proposals were in no way revolutionary, because existing plant was operating round about his figures.

Prof. E. W. Marchant asked Mr. Juhlin whether he had ever measured the temperature rise of windings by measuring their increase in resistance by superimposing a small d.c.? A scheme of that kind would be practicable. The speaker sketched a Wheatstone bridge circuit which would enable one to determine the increase in resistance of the windings when hot, with the alternator running, which would not be of very great value if thermo-couples were fitted, but if a machine was built without thermo-couples, and one wanted to find the average temperature rise of the windings it would be useful. With regard to thermal resistivity, experiments on some insulating materials used on buried cables showed that apparently, although the alteration was not very marked, there was a diminution in the resistivity with increase of temperature.

Mr. A. E. Malpas explained that the author's opening statement gave 40 deg. as the limiting temperature rise generally adopted in this country, but on the Continent the speaker had generally seen 45 deg. specified, and the difference of 5 deg., of course, gave the Continental makers an advantage in competition. To employ a liberal number of embedded temperature detectors would add to the cost of the machine, although the addition might not be very serious in the case of really large apparatus. With regard to the type of indicating device, some years ago he used a thermo-couple instrument by Le Chatelier to measure the temperature of hot gases, but found that the millivoltmeter used in conjunction therewith was so sensitive as to be seriously interfered with by stray fields. There was no d.c. anywhere near the instrument, but the conclusion come to was that atmospheric disturbances caused a great deal of interference. It happened to be very hot, dry, weather at the time, and it was conceivable that atmospheric influence could at times have the same effect in this country. For that reason, the resistance thermometer would appear to offer a great advantage, more especially as the null method of measurement was more accurate than any direct-reading method. In the case of large machines of new design, it was highly desirable to provide embedded temperature detectors, but whether the advantage to be gained by fitting those devices to every large machine turned out would justify their cost was open to some doubt. It must not be lost sight of that their use would involve some danger, since if the detectors did not happen to be placed at the spot of maximum temperature, their readings might induce the operator to overload his machine beyond the real danger point.

Mr. C. Rettie, referring to the electric propulsion of ships, the conditions in which were totally different from anything ashore, said that the sudden reversal of motors totalling 180,000 h.p. from full speed ahead to full speed astern, and also the possibility of the propellers rising out of the water and sudden turning movements, demanded a safe temperature limit for the machinery. In later ships, as well as in the *New Mexico*, a new instrument had been installed for measuring the field temperatures, which showed the temperature of the field conductor and depended for its operation on the change in resistance of a conductor with the change in its temperature.* It really indicated electrical resistance, but instead of a scale of resistance a scale graduated in degrees Fahrenheit was used. The instrument was employed on the alternator field only, no such instrument being necessary in the field of the synchronous motor. He felt they were being left behind in the development of the electric propulsion of ships. Other countries were building ships of all kinds which were being electrically driven, and were having every success.

LEGAL.

Dispute re Electrical Apprentices' Wages.

A wages dispute between Mr. E. E. Newbald, electrical engineer, Sutton, Surrey, and the Electrical Trades Union was amicably settled at the Sutton Police Court on May 12th.

Mr. Newbald's men and three apprentices, it was stated, came out on strike because he declined to pay the apprentices higher wages, and he applied to the Court for an order setting aside or rescinding the indentures in consequence of the action of the youths.

The parties, however, consulted in private, and Mr. C. Doughty, counsel for Mr. Newbald, informed the Court of the settlement. If the Court had made an order for the youths to return to work he feared they would not have done so, with the result that they would have been sent to prison. The settlement was this: The indentures of the three apprentics would be transferred to another employer, and Mr. Newbald had agreed to carry on their wages until that transfer took place, but not for longer than a month. The wages agreed upon were slightly more than the indenture wages, and the figure was fixed on pre-war wages with the addition of war increases which had been given under the various orders of the Industrial Courts. The last condition was that the men in Mr. Newbald's employ should return to work at once, and that the embargo placed on Mr. Newbald's activities should be immediately removed.

Mr. G. W. H. Jones, M.P., for the Union, said the Union was fighting for a principle which, he was glad to say, had been recognised, and in order to get rid of the differences the Union had agreed to concede half the amount.

Sir Ralph Forster, J.P.: What is the principle? These boys are serving by indenture; a rate of pay is fixed and the union comes along and says you must alter that rate. Is that so?

Mr. Jones: Not quite. We say certain awards have been made, and these boys are to benefit as a right to them.

Mr. Doughty observed that that principle, although not recognised by people not within trade unions, was established to some extent during the war, but there was nothing to-day to prevent employers paying any wages they thought fit, but if they did they would have to combat the hostility of the unions.

Hampton & Sons v. Monroe.

Mr. Edward Pollock, High Court Official Referee, on May 13th, continued the hearing of this action, which was commenced on April 18th and adjourned on the 23rd for the evidence of Mrs. Monroe, who was unable to attend owing to illness.

* Electrical Review, April 15th, 1921, p. 496.

On the case being resumed, some further evidence chiefly of a formal character was called, Mr. Pollock having in the meantime taken the testimony of Mrs. Monroe at her residence at Chessington, she being still too unwell to attend the court.

Mr. SAVILLE PERCY MORRELL, costs clerk employed by the plaintiff firm, gave evidence as to certain charges which had been made in excess of the contract prices. He said there was an amount of £105 charged, owing to increase of wages resulting from the advance in the scale upon which they had to pay, and the calculations upon which he had arrived at that figure were correct. That was upon two items only, £64 in respect of decorations and £41 in the sanitary and hot water trades. In every case he had taken the figures out of the actual wages sheets, and had rectified them in accordance with the new wages prevailing.

In cross-examination, the witness further explained the method by which he had made his calculations. He said he had the award and instructions from the head office, and on the basis of the award he worked out the increased cost by adding 12½ per cent.

Mr. COMPSTON, K.C., for plaintiffs, said that the firm had lost on two of the estimates and slightly gained on the others, but on the whole it was less than it had expected.

In further cross-examination, witness said that where the name of Mrs. Monroe appeared it was a clerical error, as most of the orders were in the name of Mr. Monroe.

The Official Referee, in the result, found that the husband and wife were jointly liable, and gave judgment against both for the sum of £4,800 with costs. He also gave judgment for the plaintiffs on a counterclaim set up by the defendants with costs.

UNAUTHORISED SUPPLY.

SUMMONED for unlawfully connecting an electricity meter with an electric line through which energy was supplied by the Wallasey Corporation, without giving forty-eight hours' notice of his intention to do so, Francis Bisson, of Trafalgar Road, Egremont, appeared before the magistrates at the Wallasey Petty Sessions on May 11th. For the Corporation it was stated that as defendant did not pay for electricity which had been supplied, the supply was cut off. Defendant afterwards paid the bill and connected the wires himself. He pleaded that he acted in ignorance. He was going to pay the bill when the workman came to cut off the supply. He told the man that, and he said that another man would be there in the afternoon to put it on again. When the bill had been paid and the man did not come, he connected the wires himself, as he had done many times aboard ship. The chairman of the magistrates agreed that defendant had done what he had no right to do, and ordered him to pay the cost of the summons.

SEDITION CHARGE.

AT the South-Western Police Court on Tuesday, Frederick Newington, district secretary of the Wandsworth Branch of the Electrical Trades Union, was summoned under Regulation 19 of the Emergency Regulations for acting in a manner likely to cause disaffection among H.M. Forces. It appeared that F. R. A. Freeman, a member of the E.T.U., joined the Defence Force, and was expelled by the branch "for conduct contrary to the interests of the union," the resolution being communicated to him by Newington. In defence it was alleged that Freeman and another were expelled because a strike was called, and instead of standing by their comrades they joined the Defence Force. The case was adjourned till June 2nd to enable the union to consider the reinstatement of the men.

BUTLER v. HAMEL.

AT the Nottingham County Court last week, Clifford Butler, trading as Clifford Butler & Co., electrical engineers, Mansfield Road, sued E. Hamel, of Holly Dene, Mansfield Road, for £17 12s. 3d. for electrical work done. Defendant admitted the claim, but he also claimed £100 from plaintiff for damage done to a candelabrum by the latter's workmen. Conflicting evidence was given as to the value of the candelabrum. Judgment was given for Butler on the claim and for Hamel on the counterclaim for £75 and costs.

BUSINESS NOTES.

Bankruptcy Proceedings.—FRANCIS EDWARD JAMES PADMORE, Marlborough Road, Nuneaton, electrical contractor.—The debtor's statement of affairs, issued by the Official Receiver (Mr. C. J. Bond, Coventry), shows gross liabilities amounting to £211, the whole of which is expected to rank for dividend. The assets are returned as "nil," leaving a deficiency of £211. Debtor gives as the causes of failure "illness of self and family; bad trade; competition in trade." It appears that he commenced business with a cash capital of £5, in November, 1918, at his present address. The only books of account disclosed by the debtor are debtors' and creditors' ledgers. He became aware of his position 12 months ago. The household furniture is claimed by his wife.

HERBERT DOYLE, trading as the Accessories Supply Co., 56, Hardman Street Deansgate, Manchester. Factor in electrical accessories.—The first meeting of the creditors of the above was held on May 11th at the Official Receiver's Offices, Byrom Street, Manchester. According to the statement of affairs submitted, the ranking liabilities amounted to £624, while the assets were estimated to realise £423. Debtor attributed his position to lack of capital, depression in trade, and general decline of the business partly owing to inattention. It was stated that the business had gradully declined since May, 1920, with the result that the debtor had been obliged to borrow money mainly from his friends. The matter was left in the hands of the Official Receiver as trustee of the estate.

S. H. DOUGHERTY (MERSEY ELECTRICAL CO.), electrical engineer, late of 36, Renshaw Street, Liverpool. Receiving order made May 12th, on creditors' petition.

W. H. PEASE, electrical engineer, late of Royal Hotel Shops, Scarborough, and Doncaster.—Last day for proofs for dividend, June 1st. Trustee, Mr. L. J. Clegg, Official Receiver's Office, 14, Figtree Lane, Sheffield.

Company Liquidations. — MORRIS, VALENTINE AND WILLIS, LTD., electrical and mechanical engineers, Highfield Avenue, Golders Green, London, N.W.—In pursuance of the provisions of the Companies (Consolidation) Act a meeting of the creditors of the above was held recently at the offices of Messrs. Bate & Co., 35, Bedford Row, London, W.C. The company, it was stated, had gone into voluntary liquidation, and had appointed Mr. A. C. Gearing, of 29, Highfield Avenue, Golders Green, London, N.W., to act as liquidator. The liquidator stated that the liabilities to the trade amounted to approximately £150, and only two firms were interested for more than £10 each. A sum of £170 was owing for rent, while Mr. Willis, one of the directors of the concern, was a creditor in respect of loans amounting to £800. Mr. Morris had also made advances to the company totalling £300. The assets of the company included stock of electrical goods, £43; mechanical stock, £23; motor stock, £599; and plant, drilling machines, &c., £200. It was pointed out that the company had not failed, but there had been some differences of opinion with regard to the management, and it had been decided in the interests of all concerned to go into liquidation, and pay the creditors in full. The two cash creditors who had been referred to would stand aside until the other creditors had been paid in full. A resolution was passed unanimously confirming the appointment of Mr. Gearing as the liquidator.

PINKNEY & FORSTER, LTD., electrical engineers, Newcastle.—At Newcastle-on-Tyne Bankruptcy Court, on 12th inst., his Honour Judge Greenwell had before him the petition of J. R. Rutherford, contractor, of 199, Westgate Road, Newcastle (a creditor), for the compulsory winding up of this company. Mr. H. S. Mundahl appeared for the petitioner, and stated that the parties were trying to arrive at a settlement by way of a voluntary winding up. In those circumstances he applied for an adjournment. His Honour granted the application.

BASTIAN ELECTRIC CO., LTD.—Following upon the recent hearing in the Winding-Up Courts, a meeting of creditors has been called for May 24th, at Carey Street, W.C. 2, for the purpose of ascertaining whether they desire the company to be wound up, and, if so, whether such winding-up shall be by the Court or voluntarily.

Trade Announcements. — MESSRS. LEO SUNDERLAND AND CO. have removed their offices only to 119, Jermyn Street, S.W.1. 'Phone, Regent 3395. The workshops and stores still remain at 33, Strutton Ground, Victoria Street, S.W. 'Phone, Victoria 3068.

MESSRS. SALTERNS, LTD., of Salterns Works, Parkstone, Dorset, have taken over the water-turbine manufacturing business hitherto carried on by Mr. P. Pitman, of 25, Victoria Street, London. The company will manufacture and sell turbines and accessories and carry on hydraulic engineering work under Mr. Pitman's supervision.

THE BORN ELECTRICAL ENGINEERING CO. has opened operations at 32, High West Street, Dorchester, and Mr. S. M. Osborn desires to receive manufacturers' catalogues.

The telephone number of MESSRS. GOLDFARB & BOTTOM, 8, Leadenhall Street, London, E.C. 3, is now "Avenue 8700"; telegraphic address, "Electengin, Stock, London."

THE CREDENDA CONDUITS CO., LTD., now has an office at 97, Waterloo Street, Glasgow.

MESSRS. D. SELBY, BIGGE & CO., consulting engineers, have removed their Glasgow offices to 121, Douglas Street, as from May 21st, their present offices having been acquired by Messrs. Scottish Oils, Ltd.

MR. FRED. LAKE has removed from 132, Upper Thames Street, E.C. 4, to 44-47, Devonshire Street, Theobald's Road, London, W.C. 1. Telephone number, "Museum 4116"; telegraphic address, "Garnham, Westcent, London."

Dissolution of Partnership.—GRASSENDALE MOTOR Co., automobile and electrical engineers and dealers, 25, Aigburth Road, Grassendale.—Mr. H. M. Watkinson and Mr. C. Sutherland have dissolved partnership. Mr. H. M. Watkinson will attend to debts.

Catalogues and Lists.—THE PERFECTA SEAMLESS STEEL TUBE AND CONDUIT Co., LTD., Plume Street, Birmingham.—An illustrated list giving prices and dimensions of steel tubes of a wide range of sizes.

THE HEWITTIC ELECTRIC Co., LTD., 80, York Road, King's Cross, N. 1.—List No. 75, giving very full particulars of mercury vapour rectifiers of different types and for various purposes. The booklet is well illustrated by diagrams and photographic reproductions.

THE SUN ELECTRICAL Co., LTD., 118-120, Charing Cross Road, W.C. 2.—List No. 313, illustrating and describing switch and fuseboards, switches, fuses, motor starters, motor control panels, charging boards, &c.; List No. 287, dealing with the "Xcel" electric iron; and List No. 324, advertising the "Lesco" electric lampholder. All three lists are full priced.

THE GENERAL ELECTRIC Co., LTD., Magnet House, Kingsway, W.C. 2.—Leaflet O.S. 2,490, dealing with low-voltage "Osram" lamps for electric signs, with bayonet or Edison screw caps. Priced. Also Folder No. OS 2,393, giving prices of "Osram" gasfilled lamps of various sizes and types; and Publication No. L 2,524, an illustrated description of train signalling or controlling by the vibratory sleeper contact.

METROPOLITAN-VICKERS ELECTRICAL Co., LTD., 20, Brazennose Street, Manchester.—Special Publication No. 7,875/2, describing loom motors for textile mills. A number of illustrations show these motors, accessories and applications, and the advantages of the electric drive for this purpose are fully set out.

MATERIEL ELECTRIQUE ALEX. LEFEBVRE, Export Department, 9, Rue Arsène Houssaye, Paris (VIIIe). List of plant for sale No. 49, giving full details and prices in francs of complete power plant and generating sets, electrical machinery, and prime movers.

MESSRS. GEORGE NOBBS, LTD., 89, Cleveland Street, Fitzroy Square, W. 1.—List No. 185, giving an illustration, prices, and description of "Genii" hot-water radiators fitted with electric immersion heaters; List No. 190, illustrating and describing "Genii" warming plates.

MESSRS. G. W. DOWDING & Co., 66, Victoria Street, S.W. 1.—List No. 64, giving an illustrated description of a grinding outfit for attaching to lathes. Priced.

Private Meeting.—WILLIAM MORRIS, electrician, Bridgend, Glamorganshire.—A meeting of the creditors was held recently at Bridgend, when a statement of affairs was submitted, which showed liabilities amounting to £406. The bank were fully secured creditors for £310, and held securities valued at £500. Debtor had borrowed £98 from his brother, which was still owing. He had a debt of £15 due to him for work done, while the house furniture was estimated to be worth £200. No offer was forthcoming, and the creditors decided, in view of that fact, that the debtor should be asked to execute a deed of assignment. The principal creditors are:—

General Electric Co., Ltd.	£205	Simpson Baker & Co.	£53
Electric Lamp Co., Ltd.	68	Metallic Electric Engineering Co.	16
Boresdale & Co.	50		

The Electrical Wages Dispute.—One of our correspondents says that most of the Electrical Trades Union men affected at Leeds are in the employ of wiring contractors, and they ceased work last week. Up to the time of writing the dispute had not affected the men employed in kinema theatres, even those in the Union, though there was every possibility that, failing speedy settlement, they would come out also. A meeting of the West Yorkshire branch of the National Federated Electrical Association, on May 11th, at Leeds, decided to adhere to the wage reduction notices. It was reported at the Leeds meeting that only a small proportion of men in Yorkshire had yet come out on strike. About half the men affected in Bradford ceased work on May 10th, but others continued at work.

The E.T.U. has issued an instruction that in the event of any employer offering to reinstate his men at the wages prevailing before the dispute, the men may return to work. Reports from some centres indicate that many men have resumed work upon these terms.

We are informed by the Secretary of the N.F.E.A. that, so far, no definite move towards settlement has been made, although it has been reported in the daily Press that the E.T.U. intends to bring the matter to the notice of the Minister of Labour for decision under the Industrial Courts Act.

So far as can be ascertained, between 8,000 and 9,000 men are idle as a result of the dispute; 2,000 of these are in the Liverpool district.

As we go to press we learn from a Blackpool correspondent that a special national delegate meeting of the Electrical Trades Union was held there on Tuesday. The Executive Council was instructed to open up negotiations at once with the employers' organisations with a view to arriving at a settlement.

Safeguarding Key Industries.—The discussion on this Bill was resumed in the House of Commons on May 12th. Various amendments were moved, but they were defeated by overwhelming majorities. They proposed the limitation of the 33⅓ per cent. duty to articles made in Germany, and to exempt optical glasses and scientific glassware.

Book Notices.—Souvenir Menu of the Twenty-First Anniversary Commemoration of the 1,000 Miles Trial of 1900. London: Iliffe & Sons, Ltd. This was presented by *The Autocar* at the banquet held on May 12th, in which only those who took part in the 1900 trial participated. The souvenir takes the form of an illustrated description of the affair, together with a list of prize-winners. The illustrations are particularly good as affording a means of comparing the cars of the far-off days of 1900 with modern automobiles.

"Useful Engineers' Constants for the Slide Rule, and How they are Obtained." By J. A. Burns, M.I.Mech.E. Third Edition. (78 pp.) London: Percival Marshall & Co. Price 2s. net.—A quantity of new material has been added to the third edition, enlarging the scope of the work, but not sufficiently to suggest an alteration of title. There is a lack of uniformity in published data concerning several of the subjects chosen, but an effort has been made to select average safe figures. In some cases (especially in the "Weights and Measures" section), the quantities have been extended to more figures than can be read on an ordinary slide rule, the object being to make the book as useful as possible.

"The Metropolitan-Vickers Gazette." Vol. VI, No. 97. April, 1921. (22 pp.) Price 1s., post free.—The April issue contains an interesting illustrated article on the M.V. patent overspeed device for electric winders, as well as a description of tests on a large alternator (illustrated), and a number of reprinted articles.

The *Journal* of the South African Institution of Engineers. Vol. XIX, No. 9, April, 1921.—This issue includes a paper on "Wire Ropes," by G. W. Westgarth, and some remarks upon the work of the Low Grade Mines Commission and its report.

"Elements of Direct Current Electrical Engineering." By H. F. Trewman and G. E. Condliffe. Pp. viii + 220, 146 figs. London: Sir I. Pitman & Sons. Price 7s. 6d. net.

"Engineering Electricity." By R. G. Hudson. Pp viii + 190, 194 figs. London: Chapman & Hall, Ltd. Price 13s. 6d. net.

"*Journal* of the American Institute of Electrical Engineers." Vol. XL. May, 1921. No. 5. New York: The Institute. Price $1.

New Swiss Company.—A new company has been formed in Geneva, with the title La Société des Ateliers de Charmille to continue the construction of hydraulic turbines formerly manufactured by Piccard, Pictet & Co.

Holland's Electrical Imports.—According to a report recently drawn up by H.M. Commercial Secretary at the Hague, Germany supplied 60 per cent. of the insulated cables and wires imported last year into Holland; the British share was only 30 per cent., the remainder coming from "other countries." As regards electric motors and transformers, Germany supplied 50 per cent. of the requirements, and Switzerland 17½ per cent. In the case of electrical instruments, 70 per cent. of the imports were of German manufacture.

Wages in Bradford.—The Advisory and Co-ordination Sub-Committee of the Bradford Corporation Finance Committee (a Sub-Committee created especially with a view to curtailing expenditure) recently received deputations from four Trade Unions, including the United Tramway and Vehicle Workers' Union, the Electrical Trades Union, and the Society of Engineers, who asked that no reductions should be made at present in the wages of Corporation employés, as had been recommended by the Committee. The Committee eventually decided to recommend to the Corporation that, as from May 18th, employés affected by national awards &c., then or thereafter in operation should be paid strictly in accordance with the minimum rates therein, provided that where this would involve a reduction of more than 2d. per hour, the 2d. reduction should be made from the 18th inst., with a subsequent reduction of 2d., or such sum as may be necessary, at the end of each four weeks, until full effect be given to the resolution. A Sub-Committee was appointed to deal with any matters of doubt or uncertainty arising out of the operation of this resolution, or in cases of special circumstances.

Rules of Golf.—We have received from the Royal Insurance Company, Ltd. (24 to 28, Lombard Street, E.C. 3) a new edition of their booklet, "Rules of Golf," as approved by the Royal and Ancient Golf Club of St. Andrews, September 28th, 1920. The Official Rules operate as from May 1st, and the booklet contains an inset showing the differences between the old rules and the new. Copies will be sent to any reader on application until the stock is exhausted.

Testing German Electrical Apparatus.—The *Technical Review*, quoting from *Elektrotechnische Zeitschrift*, says that the Association of German Electrical Engineers has drawn up new regulations concerning the organisation that it is setting up to carry out tests on electrical apparatus. It is hoped that all manufacturers in Germany will send their products for official testing by the Association, and point out in their catalogues which of their appliances have been thus officially tested. To goods that are in accordance with the regulations of the Association, a mark will be affixed, consisting of the letters VDE enclosed in a triangle with rounded corners. The tests will be carried out either at the laboratory of the Association in Berlin or at one of the accredited laboratories in the country.

For Sale.—By direction of the Disposal Board, MESSRS. KING & KING will sell by auction on June 1st and 2nd, at Eastleigh Aerodrome, plant and machinery, including electric motors, electric winches, portable telephone exchange, semi-Diesel oil engines, &c. For particulars see our advertisement pages to-day.

Electricity Supply in South Africa.—An Electricity Supply Bill is being introduced in the Union Parliament this session, containing novel and extended provisions. According to the *S.A. Mining and Engineering Journal*, it has been drawn up by a Commission, and provides for the establishment of an Electricity Board "in which the control of all electricity supply is vested, and which will decide all questions relating thereto." It also provides for the appointment of local advisory committees, consisting of suppliers and consumers, which will have no executive powers but will be charged with the duty of advising the Board. The establishment of Government generating stations is contemplated, the first of which will probably be those required for the electrification of the railways.

It is stated that the powers to be conferred on the Board are very far-reaching, and will have a great effect on municipalities which supply electricity. For instance, in the interests of economy, the Board may require the amalgamation of two or more undertakings, whether municipal or private, or may order that where an available bulk supply is cheaper than that generated by a corporation, the bulk supply shall be purchased. This would enable the Board to order the Johannesburg Town Council to obtain a supply from the Victoria Falls Power Co., which, the Commission states, is cheaper than that of the Council. Other provisions will enable consumers to obtain permission to get a supply of power from any other source than the municipal power station, and will empower private suppliers to break up streets and lay cables in a town.

Naturally the municipalities are offering strong opposition to a number of the clauses.

The Coal Dispute.—One of the most important developments of the strike has been the installation of oil-fuel burners in power stations all over the country. Leeds was one of the first authorities to realise the importance of this measure, and, as a result, it has been found possible to augment the depleted tramcar services and to maintain better supplies of power for industrial purposes. One of the largest stations in the country—Lots Road, which supplies the underground railways—is now running almost entirely on oil fuel. Other stations to which oil has been introduced include those at Hull, Sunderland, Swansea, Barrow, Blackburn, Blackpool, and Newcastle. With regard to the last undertaking it is freely stated that no attempt will be made to revert to coal, and no doubt this will prove to be the case in many instances; Swansea was contemplating the change before the mines closed down.

In spite of threats of drastic action by the transport workers, large quantities of foreign coal have been brought into the country and distributed, principally among undertakings sustaining public services. The only undertaking that has been seriously affected by the workers' objection to handling foreign coal is the L.C.C. station at Greenwich. The employés struck work on May 14th, but naval men and others have been keeping the plant running with but one or two temporary stoppages, which the *Daily Herald* describes as an "amusing result . . . owing to the blacklegs requiring a rest." The same organ states that conductors and drivers are to ballot on the question of ceasing work. The unions participating in the Greenwich strike are the E.T.U., the Dockers' Union, the A.E.U., and the Enginemen's and Firemen's Union; about 300 men are affected.

The daily loss to the State occasioned by the coal stoppage is estimated at £3,250,000, including defence measures, unemployment allowances, loss in taxes, &c.

Transformer Tenders for Wallasey.—The Wallasey Council last week discussed a situation which had arisen following its acceptance of a tender for a transformer required by the Electricity Committee. At a previous meeting the Council considered whether it should accept the quotation of a British firm at a higher cost or that of a Swedish firm at a lower, and eventually the tender of the Swedish concern was accepted. On Thursday last week, however, the deputy chairman of the Electricity Committee reported that the firm now said it had made a mistake in its offer, and wished to amend it. The tender as amended was still lower. Members of the Council expressed dissatisfaction at the course events had taken, and it was stated that there had been an irregularity in the method of receiving the tenders. It was decided to start all over again and invite new tenders.

E.T.U. Observations on the Situation.—Viewing the electrical trades through the spectacles of the Electrical Trades Union, as focused in their monthly *Journal*, employment would seem to be going from bad to worse, and the past month has seen a very large increase in the number of branches applying for funds from the General Office. "We had a somewhat optimistic feeling a little while ago," states Mr. J. Rowan, "and thought we could discern signs of a revival of trade. There is no shadow of a doubt that there are many firms declining to open out work in anticipation of a fall in wages. We cannot see that there is any justification for expecting a material decline in wages while the cost of living remains so high. The engineering employers are much more exacting in their demands than the shipbuilders, and are insisting on a reduction of 6s. and, in addition, the 12½ per cent. bonus as well. The unions have conferred on this, and while they have not yet indicated the exact steps they propose to take, they have indicated to the employers that the reduction will be resisted. The attitude of the engineering employers is all the more unreasonable when we remember that the prospects of a revival in trade are distinctly more rosy than in the case of shipbuilding. We are among those who believe that trade is already on the turn, and that before the end of the year there will be a distinct revival something approaching a boom."

The E.T.U. *Journal* reports that a Central Strike Committee has been formed for Scotland, and this has resulted in a greater co-ordination between the districts. It is also stated that the E.P.E.A. has appealed to the E.T.U. for support at Aberdeen, where it anticipates having to withdraw its members to force the Corporation to pay the agreed rates to its members. The E.T.U. has promised support.

In the organisers' reports, it is recorded that the Scottish members accepted the challenge of the Scottish Electrical Contractors' Association to fight against a reduction of 3d. per hour. The Glasgow Strike Committee had been successful in getting 40 employers to guarantee they would pay the district rate of 2s. 3d. per hour to all men in their employment.

Blackburn branch of the Electrical Trades Union reports that trade is very moderate in the district, mainly owing to the lack of supply, which it is hoped will be augmented in September, when the new power station is erected.

A new branch of the E.T.U. has been opened in Bristol.

Trade in Cardiff and the surrounding district is said to be very slack. The Gorton secretary says they are faced with the worst spell of unemployment he has yet experienced. The branch members at Govan "are not in the least pessimistic on account of the lack of work on the Clyde through depression in trade, strikes, &c."

The Mersey District Committee says it is heartbreaking to meet its members who are looking for a job. It is thought the shipping section will remain in its present bad state until the joiners' strike is settled. There are about 120 ships lying up.

A committee of kinema and station engineers' branches has been established at Liverpool, and the question of non-unionist operators has been gone into. The non-unionist question at the Liverpool Corporation is said to be well in hand. The report continues:—"The local N.F.E.A. have replied that the result of our joint meeting re regrading from Grade B to Grade A is that they cannot see their way clear to support the application in any way. I think the time has arrived for the E.T.U. to consider the question of withdrawing from the Whitley Council," states the committee's scribe.

A District Industrial Council's Report.—The first annual report of the No. 5 (West Midlands Area) District Industrial Council for the Electricity Supply Industry shows that, apart from the settlement of wages questions, the Council has in mind the other objects for which it was formed. These, while generally considered of secondary importance, will do quite as much to make for harmonious and easy running. This Council has nine representatives of municipal undertakings and three company representatives on the employers' side, while on the other side eight different trade unions are represented by twelve members. The questions to be considered include: The feasibility of preparing a scheme for indentured apprentices, and the desirability of setting up a contributory scheme for payment of sick benefits and superannuation allowances to men no longer capable of performing their duties efficiently. The accounts of the Council show a small balance on the right side.

London's Electricity Supply.—We have received from Mr. Leslie Gordon, hon. secretary of the Conference of Local Authorities owning Electricity Undertakings in Greater London, a copy of a memorandum which he submitted to the Executive Committee of the Conference on May 10th. Its purpose is to review the principal provisions of the Electricity (Supply) Bill which is now before the House of Commons, and to combat the suggestions which have been made regarding the alleged tendency of the Bill towards the nationalisation of the industry. With this object Mr. Gordon summarises the history of the subject as dealt with in the reports of the Reconstruction Committee, the Board of Trade Committee on Electric Power Supply, and the Ministry of Transport Committee of Chairmen on Electric Power Supply, showing how the recommendations of these Committees have been embodied in the Act of 1919 and the present Bill. Mr. Gordon points out that none of the schemes for the formation of a Joint Electricity Authority for the London area, whether emanating from municipal sources or from the London companies, can be carried into effect without the necessary financial powers contained in the Bill. These schemes are based upon co-operation and unity of control, with the view of stopping the waste due to excessive capital expenditure on existing but unsuitable generating stations, and effecting a great saving in working costs. He further states that the risk of any charge falling upon the rates in any part of the area is a very remote contingency.

Mr. Hoover Resigns Engineering Presidency.—Stating that he cannot remain president of a society which seeks to influence legislation, even though he be in favour of such action, owing to his appointment to an official Government position, Mr. Hoover has resigned the post of President of the Federated American Engineering Societies.

Trade Mark Applications.—Appended is a summary of the recent applications for British trade-marks in respect of goods and productions connected with the electrical trades and industries:—

Vincent (lettering and design). No. 410,072. Class 13. Electric switches, switch fuses and electrical fuses.—F. W. Abbott, trading as the Vincent Switchgear Manufacturing Co., 61, Vincent Parade, Balsall Heath, Birmingham. November 25th, 1920.

Thermica. No. 412,710. Class 50. Electric insulating materials made from mica.—Bertie G. Levis, trading as B. G. Levis, 1, Leadenhall Street, London, E.C. February 2nd, 1921.

Isolac. No. 412,869. Class 50. Electric insulating preparations and materials.—Pinchin, Johnson & Co., Ltd., General Buildings, Aldwych, London, W.C. February 26th, 1921.

Bellerite. No. 402,319. Class 40. An ebonite compound for heat-insulating purposes.—Barrett & Elers, Ltd., 127-9, Wallis Road, Hackney Wick, London, E. February 9th, 1921.

A Chave (lettering with key design). No. 411,733. Class 8. Rubber-insulated electric cables.—Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, London, E.C. January 20th, 1921.

Celec. No. 412,717. Class 8. Resistances, charging boards, switchboards, &c.—Frederick C. Curtis, trading as the Curtis Manufacturing Co., Conduit Place, Paddington, London, W. February 21st, 1921.

Maxiphone. No. 413,430. Class 8. Electrical instruments for magnifying sounds.—Herbert Powell Rees, 8, Grange Park, Ealing, W. March 15th, 1921.

Austin Motor Co.—With reference to the affairs of this company (Elec. Rev., March 13th, p. 622) the financial Press states, on the authority of Sir Herbert Austin, that all the additional finance required to put the company on a sound financial basis has been definitely settled, subject to the approval of the creditors of the company. There will not be any public issue.

The petition for the compulsory winding-up of the company has been adjourned.

The Proposed Inquiry into Industrial Unrest.—With reference to this proposal, which we discussed in a leading article in our issue of April 29th, the *Times* quotes the following terms of a reply by the Premier to a question put in Parliament by Lord Robert Cecil:—

"The Government are considering whether some form of systematic inquiry into industrial unrest is desirable, but at the moment I cannot say more. It will be appreciated that the matter is not free from difficulty; we must, for instance, remember that at the present time, by means of conciliation boards, industrial councils, and other joint bodies, negotiations are going on between employers and employed in a large number of trades, and I am glad to say that in many instances recently these negotiations have resulted in mutual agreement.

"Two years ago the Government urged upon employers' associations and trade unions the need for mutual discussion, without external interference, and I am glad to say that the views we then expressed have been accepted, as the joint negotiations now in progress show. I am sure my noble friend will agree that, in these circumstances, in coming to a decision on the matter he has raised we must consider carefully whether a general inquiry might not retard rather than accelerate the progress of these negotiations."

Electrical Trade in Italy.—The *Rivista Tecnica d'Elettricita* gives the following details of the gradual expansion in the varied uses of electricity in Italy in 1920. It is based on the Customs reports of the Ministerio delle Finanze, which compares the imports of 1920 with those of 1913. Dynamos weighing over a ton weight were imported in 1920 to a little over 10,300 tons, against 20,000 in 1913; the principal suppliers being the United States with 5,000 tons and England with 3,600 tons. Lighter dynamos were imported to 10,500 cwt. against 15,000 in 1913, the United States being again the chief suppliers with 4,500 cwt. Of transformers there were imports of a little above 1,000 cwt., contrasted with 13,000 in 1913. Taken altogether, reduction was more marked in generator and network plant and less in accessory material, the aggregate imports being 27,500 cwt. in 1920 against 73,300 cwt. in 1913—a fall of two-thirds. "Does this contraction," asks the writer, "answer to a reduction in consumption or to a growth in national output? Before the war we imported yearly about 40,000 cwt. of dynamo and transformer sheet iron—to be exact we imported 38,000 cwt. in 1913. Since then, in the six years 1914-19, the imports varied between the minimum of 33,000 cwt. (1915) and the maximum of 55,200 (1916), or an average of 45,000 cwt., and certainly by 1919 the stocks accumulated in the war period were exhausted. But in 1920 imports sprang up to 59,000 cwt., or nearly half as much again as before the war. Hence it must be concluded that the output of electric machines in Italy in 1920 approximated to 225,000 cwt., equal to the full requirements of 1913. The home consumption did not increase to the extent which these data would lead one to suppose; but, as a fact, Italy in 1920 exported over 15,000 cwt. of electric machines, a not inappreciable set-off for the 27,000 cwt. imports for the same period. These exports consisted primarily of the lighter dynamos and transformers. Hence no appreciable increase of home consumption happened between 1913 and 1920, but our output sufficed to cover our requirements and, in some lines, to strengthen our efforts abroad.

"Passing to the examination of other lines, we find that the 12,200 cwt. of apparatus, heavy and light, imported in 1913 had sunk in 1920 to 3,000 cwt.; the difference must undoubtedly have been covered by the national industry, since the consumption could not have varied greatly from that of 1913. We may recall the case of arc lamps, whose fatal decline had already begun in 1913; the 500 cwt. of that year having shrunk to 37 cwt. in 1920. On the other hand, glow lamp imports markedly bettered before-the-war figures, being 12,300,000 against 9,670,000 in 1913. In this field we have no privileged suppliers, the most important being Holland, Switzerland and Austria. Our own exports were insignificant. Electric furnace electrodes record a noteworthy advance, the 8,000 of 1913 having sprung to 50,000 in 1920, but it is to be observed that in 1919 they had risen to 150,000. Carbons for arc lamps and other small uses fell from 10,000 cwt. to 1,300 cwt. Copper wire of over ¼ mm. thickness, which in 1919 rose from about 8,700 cwt. to nearly 50,000 cwt., fell to about 6,000; while insulated wire dwindled from 3,600 cwt. to 550, and cable from 8,350 to 68. Our exports of bare wire are practically nil, but those of insulated wire advanced from 10,000 to 21,600 cwt.; electric cable from 13,000 to 23,000 cwt., and all the countries of the world strove to become our customers. In subsidiary products, imports of rubber and gutta-percha advanced from 34,000 cwt. to nearly 70,000, which figure, although the rubber industry shows undeniable progress, is a fall from the 1919 total (120,000 cwt.). Exports of rubber goods, which recorded 30,000 cwt. in 1913, rose to 69,000 cwt. in 1920."

Engineering Wages.—According to the *Daily Chronicle*, a long conference took place at York on 12th inst. between the Engineering and National Employers' Federation and representatives of the Amalgamated Engineering Union, the Engineering and Shipbuilding Federation, the National Union of General Workers, the Electrical Trades Union, and other organisations on the proposed reduction of wages in the engineering industry.

The proposals have already been stated in the Electrical Review. Our contemporary reports that the men's representatives declined to consider the employers' proposals, on the ground that they were too drastic. They also asked that the matter should be submitted to arbitration under the Industrial Courts Act. This the employers refused, and after five hours' discussion the conference broke up.

"It is understood that the men will bring the matter to the notice of the Ministry of Labour, with a request that the Government put into operation the powers of the Industrial Courts Act."

Manchester Chair of Commerce.—A new chair in the Faculty of Commerce, to be known as "Commerce and Administration," has been instituted at the Manchester University, and Mr. G. W. Daniels has been appointed first professor.—*Daily Dispatch.*

St. Dunstan's.—A copy of the sixth annual report of the St. Dunstan's Blinded Soldiers' and Sailors' Hostel has been received from Sir Arthur Pearson, the chairman of the Blinded Soldiers' and Sailors' Care Committee. It tells a wonderful story, and contains a number of photographic views of the workshops where those who were blinded, in what we trust we shall never forget was the cause of righteousness, are engaged. There are now 1,772 names on the books of St. Dunstan's; 106 new-comers were admitted during 1920, and in the course of the year 305 blinded soldiers completed their training and were set up in occupations that they had mastered. As the report shows, therefore, more than 1,200 men are already established at work.

Inquiry.—The makers of Parry (or Perry) electric punkahs are asked for.

Fire.—Fire broke out, last week, at the premises of Messrs. F. W. Birkett & Sons, Ltd., electrical engineers, Cleckheaton. The damage is estimated at £5,000.

Sports.—The Sterling Club (Sterling Telephone and Electric Co., Ltd.) wound up a very successful season on Whit Monday by defeating Great Eastern Railway (holders), who had four Essex County players in their team, by 5 goals to 2, in the final of the Ilford Hospital Senior Charity Competition. Last season as a junior team, "Stecco" won the above competition's Junior Cup. It is the first team to win both competitions in successive seasons.

A New Motor Fuel.—An experimental consignment of the new patent alcohol fuel "Natalite" will arrive at the Port of London next week, from South Africa. Natalite has been manufactured, and has been in general use, in South Africa for four years, and is now also being produced in East Africa, India, and Australia, but this is the first consignment to reach this country, and is being imported under special permit given by the Excise and Customs authorities. The whole of it will be used exclusively for demonstration and experimental purposes. Tests are reported to have shown that Natalite will give as good mileage as petrol, and in many other respects is superior as a fuel for internal-combustion engines.

LIGHTING AND POWER NOTES.

Algeria.—Power at Mine.—Considerable extensions are taking place in connection with the electrical equipment of the iron ore mines of the Société des Mines de Fer de Rouina, in Algeria. A hydro-electric power station is being established about 6½ miles away to utilise the water power of the river Cheliff. The plant will have a capacity of 1,200 h.p., and the power will be transmitted to the mines at a high voltage. The plant at the existing steam-operated generating station is being increased by the addition of a 350-h.p. engine and dynamo, bringing the capacity of this plant up to 630 h.p. The company's railway which carries the ore between the mines and the railway station at Rouina is also being electrified, while a number of electrically-operated exhaust pumps are also being installed. At the Breira Mines of the same company a generating plant of 200 h.p. capacity is being installed.

Australia.—Victoria.—Some criticism has been offered on the 25,000-kW proposal, in which two sets would be in commission, with a third set as a standby. It is said that it is "putting too many eggs in one basket." This criticism would have more weight if the Morwell scheme were entirely self-contained and independent. It will, however, be closely linked up with Newport, and so, if there were a failure at Morwell, Newport could always come to the rescue. It should be remembered, too, that if 25,000-kW sets are decided upon, this will be only the initial installation; the complete scheme provides for an output of 100,000 kW, provided either by four large sets and a standby, or by eight small sets and a standby. The small sets, with their auxiliaries, would cost more, and with them there would be a slight loss in economy. They would also be more liable to breakdown, for they would be speeded up to 3,000 r.p.m., whereas the large sets would be run only at half that speed. But whether large or small sets are decided upon will depend a good deal upon the tenders. The probability is, however, that the Electricity Commissioners would prefer large sets, other things being equal. Then the Commissioners have made arrangements for putting down an experimental briquetting plant, which will briquette 70 tons a day. The cost of this will be about £30,000.—*Reuter's Trade Service* (Melbourne).

Aylesbury.—Loan.—The Town Council has applied for a loan of £27,632 for additional plant at the electricity works.

Ballycastle (Co. Antrim).—Lighting Agreement.—The Urban Council has given instructions for the completion of the agreement with a Belfast electricity supply company for the lighting of the town.

Bristol.—Extensions.—At a meeting of the Town Council held on May 10th, a report was submitted by the Electricity Committee. This stated that it was necessary to erect a number of new sub-stations, and to alter some of the existing ones. Apart from this it was stated that large additions to the power station plant were required. The total estimated cost of these works is £200,062, and application is to be made to the Electricity Commissioners for powers to borrow this amount.

Carmarthen.—Farm Power Plant.—The Carmarthen Committee appointed to inquire into the best means of obtaining electricity for the Pibwrlwyd demonstration farm, has decided that the installation of a small oil engine and generator, at a cost of £500, will be more satisfactory than a supply from the town. It was thought that the students should have some knowledge of the working of small farm plants, and that the suggested procedure would provide additional education.

Cheadle and Gatley.—The Urban District Council has applied to the Electricity Commissioners for authority to purchase in bulk, generate and distribute electrical energy for public and private purposes in the urban district of Cheadle and Gatley.

Continental.—France.—Application has been made by a syndicate for a State subvention in aid of an electrical distribution network to be set up in the Département de l'Ain, in an agricultural district comprising 19 communes in the Cantons of Collonges, Ferney-Voltaire, and Gex. The cost of the work is estimated at 2,500,000 fr. Two networks are contemplated—high and low pressure—the former being three-phase, 15,000 volts, and the latter three-phase 200/115 volts. The length of the first network will be 57 km., and of the second 50 km. Four other syndicates, representing 30 communes, are also interested in similar schemes in the same *département*, and they are expected to eventually combine and join forces.

La Compagnie des Forges et Acieries Electriques Paul Girod, of Ugine, has applied for a concession to utilise the water power of the Doron de Beaufort Falls, near Chambery Savoy, for the generation of electrical energy. Part of the power is required for the works of the company, which has, however, undertaken to supply the electricity necessary to meet the public requirements of the Department.

Belgium.—The Société Intercommunale Belge d'Electricité is steadily extending its programme. During the past year it took over the working of the generating stations at Roux, Paturages, and Malines, while it also repurchased the plant at Sweveghem. In order to meet the increasing demand for electricity, particularly for power purposes, not only is the plant at these stations being enlarged, but new generating stations are being established at Alost and Monceau-sur-Sabre. New interconnection lines are also being established between the Monceau power plant and those at Roux and Paturages.

Italy.—A big scheme for the supply of Trieste with electrical energy and drinking water has been drawn up by the Unione Esercizi Elettrici, of Milan. The scheme proposes to extract water from the Upper Reka, and a 43,000,000 cb. m. storage reservoir fed by the Padez and Suhorka Falls. The water will be taken *via* a tunnel and cast-iron pipes to a station of a capacity of 1,700 e.h.p., equal to 10,000,000 kWh yearly; 50,000 cb. m. of the water taken from the Padez Fall daily will be filtered and sterilised. The cost of this part of the scheme is set at 50,000,000 lire. The cost of the electrical portion of the scheme is reckoned at 88,000,000 lire.

Spain.—A recent company formation in Barcelona illustrates a growing tendency in Spain to the formation of co-operative electricity supply undertakings. The Sociedad Anonima Co-operativa La Fluido Electrico has been formed by the Asociacion de Consumidores de Fuerza Motriz de Cataluna, with a capital of 25,300,000 pesetas, the whole of which has been subscribed by its founders, who themselves will be the chief consumers of the energy produced. This is estimated at 25,000 h.p. at the least, but will probably be raised to 75,000 h.p. by the absorption of the Sociedad Hidrcelectrico del Cadi, a company formed a year ago with a capital of 7,500,000 pesetas, whose assets include seven waterfalls on the slopes of the Sierra del Cadi (Province of Lerida), and the rivers La Vausa, Cardoner, and Segre, whose aggregate output is estimated at about 140,000 h.p. The Co-operativa also owns falls on the River Esera, and has taken over the shares of the Sociedad Espanola de Construcciones Electricas (formed in 1912 with a capital of 12,500,000 pesetas), with its works and trained staff.

Derby.—Fire at Power Station.—A fire in the basement of the power station, on May 13th, did considerable damage, and also seriously interfered with the whole supply of power, the tramcars being stopped for several hours. The fire started, it is believed, through the fusing of a cable, and the Derby Fire Brigade was promptly summoned. With water from two standpipes they confined the fire to the basement, and soon extinguished the flames. James Morell (59), a cleaner, was badly burned about the hands, arms, and face, and had to be taken to the infirmary.

Glasgow.—Inspection of Housing Scheme.—The Corporation electrical engineer has called the attention of the Corporation Housing Committee to the working-class garden village at Billingham, near Stockton-on-Tees, where, apart from the domestic hot water supply, which is afforded by a boiler behind the coal fire in the living room, all heating, cooking, and lighting are done by electricity, and the Committee has agreed to send a deputation to inspect them.

Grange.—Council's Protest.—The Urban District Council has informed Messrs. T. Wilkinson (Arnside), Ltd., who supply electricity to the town, that unless a circular issued with regard to the minimum charge for energy is withdrawn, the Council will give notice to terminate the agreement with the firm.

Harrogate.—Loan Sanctioned.—It was reported at a Town Council meeting, on May 9th, that the Electricity Commissioners had sanctioned the borrowing of £46,000 for electricity purposes.

Hull.—Area of Supply.—The Corporation is applying to the Electricity Commissioners for powers to extend the area of supply of electricity in the Western area of the rural district of Sculcoates, and to alter the maximum price and the method of charging.

India.—Gersoppa Electricity Scheme.—The chief engineer of the Government of Mysore has submitted his report on the scheme for harnessing Gersoppa Falls with the object of producing electric power. The total cost of the scheme is estimated at about Rs. 4½ crores.—*Reuter's Trade Service* (Bombay).

Calcutta.—A Special Committee of the Municipal Council states that it is unanimously of opinion that if any concession is to be granted to the Calcutta Electric Supply Corporation, Ltd., it should only be on the basis of a corresponding concession to consumers in the matter of rates. It suggests, therefore, that in the matter of the extension of the period of option for the purchase of the undertaking, in the manner suggested by the company, the question of reduction of rates (whenever practicable) in the interests of the public, should be safeguarded by the Government.

Jedburgh.—Price Increase.—An order has been issued authorising the Electric Supply Corporation to increase the charges for electricity from 10d. to 1s. per unit as from January 1st last, and to impose minimum charges of 15s. up to 15 units for each winter quarter, and 10s. up to 10 units for each summer quarter. The company had asked for power to charge up to 1s. 2d. per unit.

Lyme Regis.—Purchase of Undertaking.—The Town Council has decided to seal the contract for the purchase of the undertaking of the E.L. & P. Co., Ltd., October 1st being the date for the completion of the purchase.

Lynn.—New Plant.—At a recent meeting of the Town Council, the electrical engineer reported that the new turbo-generator set and rotary converter had been completed. The Electricity Committee arranged a visit of inspection.

Matlock. — Proposed Hydro-Electric Scheme.—Another small scheme for the utilisation of water power for generating electricity has been put before the Urban District Council by a Mr. Pearson. He suggests the construction of works on the Derwent, near the new Suspension Bridge.

Mexico.—Power Company's Extensions.—A cable from a special correspondent of the *Agence Economique* states that the Mexican Light and Power Co. is going to install a turbine of 6,000 h.p. and a new power set of 20,000 h.p. The company has just secured the funds necessary for the utilisation of a 60,000-h.p. waterfall. The work will occupy two years. The company suffers much from the drought, and is now obliged to make use of petrol engines.—*Financial Times.*

Nuneaton.—Street Lighting.—On May 6th, Major Stewart, O.B.E., R.E., of the Ministry of Transport, held an inquiry into the circumstances attending the Borough Council's application for sanction to borrow £1,050 for the purpose of street lighting. The electrical engineer, in reply to the Inspector, said that this requirement was not foreseen when the previous amount for the same purpose was applied for. They had spent nearly £2,500 already this year out of revenue, and it was impossible to meet any more charges in that way.

Redditch.—Financial Position of Undertaking.—At a recent meeting of the Urban Council, it was reported that the electricity undertaking had incurred a heavy loss, the liabilities totalling £17,651. The only remedies were said to be increased charges or the levying of a general district rate of 2s. 6d. in the £. The latter course is being adopted subject to the approval of the Finance Committee.

Scunthorpe and Frodingham.— Bulk Supply.— The Urban District Council is applying to the Electricity Commissioners for authority to purchase electricity in bulk from Messrs. John I ysaght, Ltd., or any other company, and to supply the same for public and private purposes within the urban district of Scunthorpe and Frodingham.

Stafford.—Year's Working.— The accounts of the electricity department for the year ended March 31st last, show an income of £20,817 (an increase of £4,007), and expenditure of £15,984 (an increase of £3,992) leaving a trading balance of £4,833—an increase of £15. Deducting loan charges, income-tax, and a deficit brought forward, there was a surplus of £501. The Mayor (chairman of the Electricity Committee) said they had made a profit of £500, but this had been done by taking money from the depreciation account to wipe out some of the deficits. Alderman Bostock said there had been a serious falling-off in the sales, and this seemed likely to continue unless trade took an unexpected turn. They were at a critical point with regard to the undertaking, and it was of the first importance to secure an increased number of consumers. To do this there would have to be a considerable outlay on new mains, which would not be immediately remunerative.

Sunderland.—Price Increase.—The Town Council has adopted a revised tariff for supplies from the low-pressure network, to take effect from the June meter readings. The general effect of the new tariff is to raise prices by about 10 per cent. It was argued that the small consumers were being penalised by this increase in order that the large users could continue to receive supplies of power at a low cost, but the chairman of the Electricity Committee replied that the new charges were justified, and were the lowest they could impose to ensure the prosperity of the undertaking.

Surbiton.—Report Upon Meters.—Complaints having been received from consumers that the amount of power registered by their meters seemed to be excessive, Mr. A. H. Preece, of Messrs. Preece, Cardew, & Rider, was asked to report on the matter. He considers the meters, all of which are of reliable make, are accurate, but that any tendency towards incorrectness is in favour of the consumer. The methods adopted by the supply company for testing the meters are stated to be excellent. The report was considered satisfactory, and was adopted.

Taunton.—Public Lighting.—The borough electrical engineer informs us that the whole of the public lighting standards in the main streets have been fitted with 200-W gasfilled lamps in Holophane "Refractor" fittings. The illumination is quite equal to the old seven-ampere open type d.c. arc lamps.

Liquid Fuel.—The boilers are being fitted to burn liquid fuel in place of coal. It is expected to effect a saving in the fuel bill as well as to make the undertaking independent of coal supplies.

Extension.—The Council is applying for an order authorising a supply to certain farms and residences in the Norton Fitzwarren and Bishops Lydeard districts through 2,200-V single-phase overhead mains.

Tregaron (Cardiganshire).—Proposed Water-Power Scheme.—A committee has been formed with the object of establishing electricity works in the town. It is proposed to utilise water as the motive power.

Worthing.—New Plant.—The Electricity Committee reports that it will be necessary to install a 350-kW generating set to meet the probable requirements of the undertaking by the winter of 1922, and the electrical engineer has been instructed to prepare specifications and plans with a view to tenders being invited in the early autumn.

TRAMWAY AND RAILWAY NOTES.

Australia.—Electrification of Melbourne Railways.—The latest railway figures published show that the partial electrification of the Melbourne suburban railways has proved a great financial success, the saving effected thereby amounting already to £191,000 per annum.—*Reuter's Trade Service* (Melbourne).

Bootle. — Track Renewals.— A resolution of the Electric Power and Lighting Committee deciding that the work of relaying the troughing for tramway purposes throughout Strand Road should be proceeded with at an estimated cost of £1,040, and that the expenditure be defrayed out of the electricity reserve fund account, has been approved by the Town Council.

Continental. — Spain. — The Railway Bill, recently brought before the Legislative Chamber by the Minister of Public Works, seeks to nationalise the railways when this is considered expedient. In the meantime a close arrangement is to be made between the railway companies and the Government. If necessary, rates are to be brought down to below working costs and the deficit will be made up by the State. Sanction is sought to construct new lines, and for the subsequent electrification of the railways.

Exeter.—Offer of Purchase.—At a meeting of the City Council on May 10th, it was reported that the National Electric Construction Co. recently had inquired whether the Council was disposed to sell or lease the tramway undertaking, and the Tramways Committee recommended a reply in the negative.

A £4,000 loss on the tramways had been included in the estimates, and at previous meetings the question of sale had been mooted. There was a disposition to criticise the committee for not putting fuller particulars of the offer before the Council. Mr. M. J. McGahey thought the majority of the Council might be against selling or leasing, but some were in favour of it. Mr. Towill, chairman of the committee, said the committee was unanimous in its recommendation. It was decided to report further at the next meeting.

Electric Vehicles.—Reference was made in the accounts to £500 expenditure in connection with electric vehicles. Mr. J. S. Steele-Perkins thought there should be a fuller report. The Council had been promised a large reduction in men and horses through the introduction of the vehicles. He supposed the committee concerned had spent between £7,000 and £8,000 in connection with these vehicles. The surveyor said he had promised a report after the vehicles had been in use for three months.

Stockton-on-Tees.—Loan Sanctioned.—The town clerk reported at a recent meeting of the Town Council that the borrowing of £155,201, repayable in 30 years, in respect of the purchase of the tramways had been sanctioned.

South Africa. — Railway Electrification. — In the Union Senate, on April 6th, Mr. Ehrlich asked the Minister of Railways and Harbours :—(*a*) Is the Minister aware that the High Commissioner's office in London, on behalf of the Railway Department, has called for tenders for various supplies required for the electrification of the line from Cape Town to Simon's Town and from Durban to Maritzburg, and the time for tendering expires on May 2nd next? ; (*b*) does the Minister, at this inopportune time, intend to accept a tender, or will he agree to suspend these works and divert the money required, and estimated at nearly five millions sterling, to the building of new lines instead, and thus provide nearly 1,000 miles of additional new railway lines for the opening up of the country not yet served by railways, and provide work for many unemployed?

The reply was :—(*a*) Yes ; (*b*) the estimated cost of the electrification scheme as sanctioned is £4,385,400. Electric traction is being introduced in South Africa for the same reason that it is being introduced in other parts of the world—namely, to effect economy in working, and help to counteract the large and universal increase in operating costs. Traffic has fallen off somewhat on certain lines, and the outlook at the moment is not so reassuring as when the electrification scheme was sanctioned, but, while reasonable prudence must be observed in capital expenditure, it would be unwise to provide for the future on the basis of present-day trade and traffic conditions or the present-day outlook, which are abnormal and transitory. The desirability of constructing additional developing railways for the opening up of the country districts is appreciated, and is likely to be hastened, rather than retarded, by the introduction of modern and economical methods of working. To build a large mileage of branch lines at the expense of modern methods would only mean increasing the loss on working without introducing any counterbalancing economies in the operation of existing lines.—*South Africa.*

While the Government is proceeding with the electrification of the Natal line, owing to the financial position it is postponing temporarily the electrification of the Capetown-Simonstown line.—*Reuter's Trade Service* (Capetown).

Southend.—Railless Cars.—A deputation appointed by the Southend Corporation to inspect the railless system at Rotherham, Bradford, and York recommends the adoption of the system in Southend, stating that the cost of power for driving a railless trolley car is 1 1·7d. per mile, as compared with 5d. per mile for a petrol 'bus. In its report to the Corporation the deputation says that the systems in Rotherham and Bradford were amongst the first to be operated in this country. The York system was started last December. Rotherham and Bradford having old systems and rolling stock of the earliest type, with complicated propelling machinery, the cost of upkeep is heavy, and in both these towns it is proposed to scrap the existing rolling stock, and to build entirely new and up-to-date vehicles. Last year there were losses of £1,650 at Rotherham and £10,000 at Bradford, but the engineers there are of opinion that when modern cars are secured the undertakings will be able to operate at a profit. At Bradford the deputation saw the experimental double-deck vehicle, which seats 57, and reports that it ran smoothly and satisfactorily. Districts served in Rotherham and Bradford would not have justified the heavy expense of ordinary tramways. In York the railless service is through narrow streets, which forbade the installation of tramways.—*Electric Railway and Tramway Journal.*

TELEGRAPH AND TELEPHONE NOTES.

A Magnetic Storm.—The electrical storm which had been growing since May 13th became so violent on the 15th inst. that it caused widespread interruption of telegraphic communication. One of the first warnings of the magnetic disturbance came last week when wireless telegraph operators on the "airways" between London and the Continent reported frequent interruptions in the continuity of their messages. Another symptom was seen on the night of the 13th, when Aurorae Borealis were observed about 11 p.m, from the aerodrome at Croydon, Surrey, in the form of a band of light across the sky, which appeared to alternately contract and expand. The severity of the storm put out of order for a time the telegraph and telephone services in Sweden, and it was impossible to communicate between Stockholm and Gothenburg from 10 p.m. on the 13th until 8.30 a.m. on the 14th. A fire was started at the Karlstad (Sweden) telephone exchange, which was destroyed, and electrical flashes were observed at other telegraph and telephone offices. "A very nice sunspot has appeared," Sir Frank Dyson, the Astronomer Royal, reported on the 15th, "and although I do not know that sunspots cause magnetic storms, they often come together. The sunspot will go round with the sun in 25 days, but the magnetic storm will not last as long as that." A New York message says that Aurora Borealis, on the 14th, caused one of the most severe electrical disturbances there for 30 years. Nearly every telegraph wire in the United States outside New York was out of order. The Naval Observatory at Washington considers the phenomenon due to a sunspot, which was estimated to be 94,000 miles long and 21,000 miles wide, and which was observed and photographed on the 10th and 11th.

The *Daily Chronicle* states :—"A group of sunspots, of quite exceptional size, is at present visible on the sun, one of the individual spots being large enough to be seen with the naked eye. The group stretches from near the centre of the sun almost halfway to the western limb, and extends for at least 150,000 miles in length. The total area occupied by the group is probably not less than 2,000 million sq. miles, and the largest spot which is nearest the sun's limb, exceeds 700,000,000 sq. miles in area."

On Sunday last the storm abated, but there was a fresh increase in intensity about 3 a.m. on Monday morning, and by noon the disturbance was believed to be over. Meanwhile, although British postal authorities suffered but little from the disturbance, which happened during a quiet period of telegraphic and telephonic transmission, cable companies and wireless operators found repeated breaks in messages both from America and Canada, and from practically every part of the world. At the offices of the Western Union Co. the effect of the storm was very pronounced.

An Aurora Australis was distinctly seen in Australia and New Zealand on Sunday night. Telegraph circuits throughout Australasia were affected.

Mr. Carlton, President of the Western Union Telegraph Co., announces that the damage done by the storm on Saturday evening may necessitate the lifting of some of the trans-Atlantic cables for repairs. He says the oceanic currents accompanying the phenomenon found out the weak spots in the insulation and aggravated them, thus interrupting the service.—*Reuter's Trade Service* (New York).

Peru.—Concession to Marconi Co.—The Peruvian concession to Marconi's Wireless Telegraph Co., of London, to operate the Peruvian wireless postal and telegraphic services for a period of 25 years, has been made the subject of representations by the United States Government. The communication to the Peruvian Government has not been published, and officials of the State Department decline to discuss it, but it is learned that it is not in the form of a protest.—*Reuter's Trade Service* (Washington).

River Plate.—Cable Renewals.—The directors of the "Compania Telegráfico-Telefonica del Plata," in their report for the year ended December 31st, 1920, state that their lines continue to receive preference for communications between Buenos Aires and Monte Video. Working results amounted to $504.715.49 m/n. as against $379.114.69 m/n. in the previous year, but expenses of administration rose from $266.447.61 m/n. to $332.452.46 m/n. Some extraordinary expenditure was incurred on repairs, primarily for mending cables which had been cut in several places, due to the resumption of sailings by large trans-Atlantic liners. It was also found that the old cables were in such a bad state, owing to their lengthy use, that they might easily have endangered the security of service, and the Board arranged immediately to replace them. Two new single-conductor cables arrived at the end of the year, the laying of which was expected to be completed during March. The cost of these cables and of laying them amounted to $160.000 m/n., and as the company had only recently terminated the construction of the two new conductors mentioned in the preceding report, it was necessarily obliged to have recourse to credit. The Board was unable to recommend the distribution of a dividend, and placed towards the amortisation of the cables the surplus of $126.436.70 m/n.—*Review of the River Plate.*

South America.—Improved Cable Facilities.—Mr Carlton, president of the Western Union Cable Co., stated before the Commerce Committee of the House of Representatives that his company expects to double its cable facilities to the South American east coast, and also to lay a cable on the west coast of that continent.—*Reuter's Trade Service* (Washington).

The Telephone Service.—The Postmaster-General in reply to a question in the House of Commons, said that the number of subscribers who had given up the telephone owing to the increased charges was rather less than 3 per cent. of the number of those who had so far signed the new agreement, and if that proportion was maintained throughout, the gain from the revised tariff would not be seriously affected.

U.S.A.—Wireless Phenomena.—A co-operative study is being carried on by the American Radio Relay League and the Bureau of Standards, tests having been conducted during June and October, 1920, and January, 1921. A further series of tests was to be carried out in April, in which from five to ten stations were to transmit signals in succession, these signals being received simultaneously at about 100 receiving stations, whose operators were provided with forms for recording the variation in the intensity of the signals as received. A paper presented before the Philosophical Society at Washington on January 29th described the results of the tests so far conducted and proposed an explanation of the phenomena which associates the long-distance transmission accomplished at night with the boundary of the highly conducting outer portion of the atmosphere, which is also the origin of auroral disturbances. Fluctuations in intensity are probably caused by irregular absorption of the waves by masses of slightly ionised air through which the waves travel in their course. The fading phenomena are closely associated with the strays or atmospheric disturbances which affect all radio communication.—*T. & T. Age.*

Wireless Telephony.—On May 11th two representatives of *The Times*, one at Zandvoort, in Holland, and the other at Southwold, on the East Coast between Lowestoft and Harwich, held a conversation lasting 50 minutes without an interruption by wireless telephone across 125 miles of the North Sea. The experiment, which was completely successful, was arranged by the Marconi Co., which has been granted a licence by the British and Dutch Governments to test its newest apparatus. The station in Holland is only a temporary one, but that at the English end is fully equipped; the familiar telephone receiver and transmitter were used in conjunction with valve amplifiers, and it is stated that a new screening device was employed which warded off alien disturbances of natural origin, and (at least, to a greater extent than has hitherto been achieved) even those caused by other wireless waves. Hitherto, when speaking with the aid of wireless, it has been necessary for the first speaker to finish what he had to say, and then switch over from the transmitting to the receiving circuit before being able to listen to incoming speech. This process, however, has not only been done away with, but apparatus is practically perfected, so that instead of there being the necessity of keeping a watch on the instrument for calls, it will be possible to ring up a wireless telephone station in just the same way as one rings up on the ordinary line instrument.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia. — Melbourne. — June 15th. Victorian Government Railways. 50 oil-immersed single-phase track and signal transformers for power signalling (Contract No. 33,901).*

June 22nd. One electric lifting magnet (capacity ½ ton), one 440-V motor generator.*

June 29th. Supply of 1-ton platform type industrial storage battery trucks, also battery-charging equipment.*

August 10th. 250 core-type impedance bonds for power signalling, with a capacity of 1,000 amperes per rail; also 50 miles of solid insulated copper wire, No. 14 Brown & Sharpe gauge, and 50 miles of solid insulated copper wire, 16 standard gauge.

August 17th. 3,000 sets of renewals for caustic soda primary cells.

August 30th. Board of Works. Four electrical centrifugal pumps, each with a capacity of twelve million gallons daily.

Aldershot.—May 24th. Urban District Council Electricity Department. Three miles of 6,000-volt, 3-phase cable. (May 13th.)

Belgium.—ANTWERP. May 27th. Municipal authorities. Paper-insulated telegraph cables required in connection with the fire brigade service. Particulars, 1 franc, from the Service Electrique, Hotel de Ville, Antwerp.*

June 7th. Municipal authorities. Construction of a transformer post at the canal dock. Particulars for one franc from the Service Electrique, Hotel de Ville, Antwerp.

June 30th. Municipal authorities of Lokeren. For an underground system of electricity supply mains. Particulars (15 francs) from the Directeur des Services du Gaz et de l'Electricité de la Ville de Lokeren. Tenders to the College des Bourgmestres et Echevins, Hotel de Ville, Lokeren, by registered post.

Brighton.—June 7th. Electricity Department. Oil fuel plant. (See this issue.)

Canada. — EDMONTON. — Provincial Government of Alberta. Construction of 2,000 miles of pole lines for telephones and stringing 4,000 miles copper wire.—*Reuter's Trade Service.*

Doncaster.—May 23rd. Tramways Department. Doubling of Balby route, from Cleveland Street to Balby Bridge. Mr. F. O. Kirby, borough engineer, 2, Priory Place, Doncaster.

Dundee.—Corporation. Electric lighting fittings for new City Hall and for the supply of a kinematograph and appliances. Mr. Jas. Thompson, city architect.

June 6th. Electricity Department. One coupled motor-generator, consisting of two interpole machines; motor, 400 V, d.c.; generator, 75 V, 130 amp.; also regulator, 60 to 70 V. (See this issue.)

Fiji.—SUVA.—June 30th. Municipal Council. One 200-kW, 480/520-V, 3-wire, d.c. generator, directly coupled to a 300-h.p. vertical Diesel oil engine, with accessories and generator panel. Specifications (21s.) from the Town Clerk, Suva, Fiji, c/o Box 2,557, G.P.O., Sydney.

France.—French Post and Telegraph authorities, Paris. A 60-element battery of accumulators of 1,500 amp.-hour capacity for the wireless telegraph station at Ouessant (Finisterre).

Glasgow.—May 31st. Electricity Department. Cables (including small i.r. cables and flexibles) and meters for twelve months. (May 13th.)

Gravesend. — May 24th. Town Council. Electrical wiring of houses, King's Farm Estate. Borough Engineer.

Huddersfield.—May 28th. Electric light installation in United Methodist Church and School, Outlane. Mr. F. Roberts, Maplin Lea, Lindley Moor, Outlane.

London.—SHOREDITCH.—June 7th. Electricity Department. Constructional steel and ironwork building, 20-ton weighbridge, h.p. steam pipes, valves, &c., for Whiston Street generating station. (May 13th.)

Mexborough. — May 21st. Urban District Council. Electricity Department. One 750-kW rotary converter with transformer. (May 6th.)

New Zealand.—June 28th. Public Works Department. Ten s.p. oil-filled transformers for the conversion of three-phase current at 50 cycles, the voltage ratio being 50,000/11,000, for Waikato power scheme.*

June 28th. Supply and delivery at Lyttelton of two 50-kVA, two 100-kVA and two 200-kVA condensers in connection with the Lake Coleridge electric power supply (Section 116).*

WELLINGTON.—June 14th. Post and Telegraph Department. 7,460 lamps, various voltages.*

August 9th. Public Works Department. Suspension-type porcelain insulators for the Waikato power scheme.*

Oldham. — Electric lighting of 50 houses at Hollin's housing site. Particulars from Borough Surveyor's Office.

South Africa.—July 5th. Electrification of Capetown-Simonstown and Durban-Maritzburg lines.

Wimbledon.—May 25th. Electricity Committee. H.p. sub-station switchgear. (May 13th.)

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

CLOSED.

Australia.—A Reuter dispatch from Melbourne states that the Victorian Electricity Commission has accepted a single American tender of £379,000 for switchgear and transformers. It is stated that this figure represents a saving of £200,000 on a combination of sectional tenders by various British firms, and that no British firm put in a tender for the material in one lot.

Barnsley.—Town Council :—
H. and l.p. cables, £5,821.—Western Electric Co.

Erith.—Urban District Council :—
Cables, &c., for the bulk supply from Woolwich.—Callender's, Ltd.

France.—La Société des Constructions Electriques de France, of Paris, has secured the contract for the electric locomotives and the equipment of the hydro-electric power generating stations required in connection with the electrification of the steam railways of the Compagnie des Chemins de Fer du Midi.

Glasgow.—Corporation. Electricity Department. Accepted :—
Cast-iron boxes, section pillars, &c.—J. Allan, Sen., & Sons; James Carmichael & Co., Ltd.; Carron Co.; Falkirk Iron Co., Ltd.; Lion Foundry Co.; McDowall, Steven & Co.
Malleable iron tube and fittings.—Scottish Tube Co., Ltd.

London.—ST. MARYLEBONE. — Electric Supply Committee :—
Constructional work in connection with the new boiler-house and pump-room extension, £23,495.—A. E. Symes (recommended).

Worksop (Notts.).—The Urban Council has accepted the following tenders in connection with the supply of electricity from the Manton Colliery :—
Cables, £13,042.—W. T. Glover & Co., Ltd.
Switchgear, £3,764; transformers, £3,228; and rotary converter, £4,831.—Metropolitan-Vickers Electrical Co., Ltd.
The total cost of the scheme will be £23,166.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, May 20th. At Caxton Hall, Westminster, S.W. At 8 p.m. Lecturette on "Liquid Fuels," by Mr. A. Arnold.

Friday, May 27th. At Caxton Hall, Westminster, S.W. At 8 p.m. "Notes on Electrical Transformer Breakdowns," by Mr. S. A. Stigant.

Royal Photographic Society (Scientific and Technical Group).—Tuesday, May 24th. At 35, Russell Square, W.C.1. At 7 p.m. Discussion, opened by Mr. J. C. Elvy, A.M.I.E.E., on "Illumination Problems in Kinematography."

Institution of Electrical Engineers.—Thursday, May 26th. At the Institution, Savoy Place, Victoria Embankment. At 6 p.m. Lecture on "A Physical Phenomenon and its Application to Telegraphy, Telephony, &c.," by Messrs. A. Johnsen and K. Rønbek.

Wireless Section Meeting.—Wednesday, May 25th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 5.30 p.m. Discussion on "Long-distance Wireless Transmission." To be opened by Mr. C. F. Elwell.

Institution of Mechanical Engineers.—Friday, May 27th. At the Institution, Storey's Gate, Westminster, S.W. At 6 p.m. Special meeting.

Physical Society of London.—Friday, May 27th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary meeting.

NOTES.

Eight-Hour Day Bill Passed in Belgium.—The Senate, on May 13th, passed the Bill providing for the establishment of an eight-hour day and a 48-hour week. An amendment was made in the Bill as originally presented whereby the King was empowered to suspend the application of the limitations provided in the Bill in the event of war, or of any other emergency constituting a danger to national security, and when advised by the Supreme Councils of Labour and of Industry and Commerce that such a suspension was required as a matter of national necessity, in order to ensure by the development of the export trade the means of exchange indispensable for the importation of foodstuffs.—*Reuter's Trade Service* (Brussels).

Reproduction of Speech by Galena and Undamped Waves.—As far back as 1913 Brazier and Dongier showed that the passage of a sufficiently strong alternating current across the surface of contact of a metal point with a crystal of galena caused a sonorous effect. Mr. P. Collet (*Comptes Rendus*, June 7th, 1920), in continuing these experiments used a primary circuit in which undamped waves were set up, and a secondary circuit, entirely separate from the primary, and tuned to it by means of a variable condenser. From the terminals of this run off two line wires several metres long, at the end of one of which is a crystal of sensitive galena, while a platinum point is at the extremity of the other touching the galena, thus forming a circuit shunting the condenser. The point is fixed to the centre of a phonograph disk mounted on the horn of the instrument, and if the secondary circuit be turned to the primary, and the latter be periodically interrupted by a tuning fork, then the phonograph will emit a note of the same pitch as the fork. When a carbon microphone was joined in the secondary circuit, the sounds of a voice speaking in front of it were reproduced in an adjacent room with great intensity and with remarkable fidelity in quality; the singing voice was likewise admirably rendered in all detail. There is no advantage gained by using loud voices or intense currents. The phenomenon is attributed to thermal effects, being kindred to the Trevelyan rocker made well known in America by Prof. Tyndall half a century ago.—*Journal* of the Franklin Institute.

Electrical Adhesion.—The following is a synopsis of the lecture by Messrs. Alfred Johnsen and Knud Rahbek, which will be delivered before the Institution of Electrical Engineers on May 26th (see "Institution Notes").

The lecturers discovered in 1917 that strong adhesive forces were developed in some cases where an electric potential difference was applied to a solid body consisting of certain badly conducting materials, i.e., various minerals, and a conducting body, such as a metal disk, resting on the former body. This adhesion was found to be proportional to the true area of contact between the bodies, so that ground and polished surfaces fitting accurately together afforded the best results.

It was found that the adhesion was due to an extraordinarily strong electrostatic attraction between the two surfaces in contact. The solid materials in question conduct electrolytically, and show a very high contact-resistance with regard to an adjacent conductor, if no conducting liquid, cement, &c., be interposed between the two surfaces. The contact resistance can greatly exceed the interior resistance in the material used. If a potential difference be applied to the metal disk and a metal electrode cemented to the semi-conductor (as the material may be called), a weak current will flow through this semi-conductor and across the contact surface to the metal disk. This causes a finite potential difference between the surfaces in contact, due to the very high contact resistance. The result is an unusually strong static attraction, which may easily be understood if it is borne in mind that the attraction between the plates of an "air condenser" for a given potential difference between the plates is proportional to the inverse square of the distance between the plates. The distance between the attracting surfaces being, theoretically, in this case zero, an infinitely large attraction should be expected. In practice, a limited attraction is manifested, the limitation being probably due both to electrolytic phenomena and to ionisation; nevertheless, an exceedingly strong attraction can be obtained at moderate potentials. It has been found that an electrostatic attraction of several pounds can be obtained between a thick lithographic stone, fitted with an electrode at the back, and a metal disk, two inches in diameter, resting thereon, when a potential of 440 volts is applied. The current is of the value of a few micro-amperes. The disk will lift the stone in an exactly similar manner to that in which an electromagnet can be lifted with its armature, and the stone will drop if the current be interrupted. Similar qualities are exhibited by flint, agate, some species of slate, and many other minerals and salts, as well as many organic substances, for instance, animal membranes, skin, gelatine, bone, &c. On the other hand, the experiment cannot be carried out with true insulators, such as glass, mica, ebonite, &c., as the necessary current cannot flow.

The attraction naturally causes a considerable friction between the two surfaces. This is utilised for technical purposes by using the semi-conductor in the form of a cylinder, maintained in rotation, and on which a metal band slides. As soon as a suitable potential is applied to the apparatus the band will adhere firmly to the cylinder, and can be made to operate various devices, the whole forming an effective electrostatic relay. In connection with telegraph apparatus, it is essentially useful as a radio recorder, the current from ordinary small valves being sufficient for its operation at a speed up to several hundred words per minute, if a sufficiently high potential (100 to 200 volts) be used for the valves. If the metal band be connected to a diaphragm or similar sound-reproducer, and telephone currents be applied, a very loud-speaking telephone is obtained. This and other applications, among which is a low-pressure pocket electroscope, will be demonstrated at the lecture.

It is obvious that the phenomenon forms a wide basis for scientific investigation, and that it will probably in the future be used for the construction of electrical apparatus for various purposes, especially in cases where a small current consumption is essential.

Australian Wiring Rules.—The Fire Underwriters' Association of Victoria announce several alterations and additions to the general wiring rules previously issued.

According to the *Australian Mining Standard*, in the rule specifying minimum size of conductor, an alteration is made in the wording to conform with the new method of defining size of conductors. Under the heading "Cased Wiring," a clause is added to the effect that metal conduit of class "B" must be used when protecting conductors any one of which conveys 50 amps., or more, while wood casing must not now be laid under floors, in hollow walls or where liable to be damaged by rodents. Insulated conductors, protected by an outer reinforcing cover of tough rubber compound, &c., may now be used when in view or not exposed to mechanical injury or damage by rodents, subject to the conditions obtaining in the rules as previously set out. Unarmoured conductors having a lead sheathing, &c., must be protected when laid between walls, &c., where liable to damage by rodents. Flexibles may be used for connections to lifts, subject to their being supported by porcelain insulators, and of such length that they will not come into contact with the bottom of the lift well when the lift is at the lowest point of its run. Unless permission be obained from the inspector, no flexible extension shall be taken across a ceiling to a drop-light or other fitting. Switch and distribution boards must be so arranged that a fire therein cannot spread, whether occurring at the front or back, and when placed on or within 6 in. of a wooden wall or 18 in. of a wooden ceiling, a thickness of hard insulating fire-resisting material is to be placed between switch or distribution boards and the wall or ceiling, and must extend at least 6 in. beyond the board all round. Wire, &c., passing through this material must fit the holes through which it passes as tightly as possible. Switch and distribution boards must be fixed on incombustible supports. The space at the back of the boards shall in no case be less than 4 in. between any live metal and the wall, supports, or tubing, except that where the potential above earth does not exceed 250 volts, the provisions of 87 (c) shall apply, and the distance between charged metal parts of fuses connected to opposite poles or phases shall be 4 in.

Educational.—In its report for 1919-20, the University Grants Committee comments on the large increase in the number of students which has occurred since the close of the war. Excluding Universities which are not in receipt of annual grant aid, and those institutions receiving a grant for the first time in 1919-20, the figures compare as follows for full-time students in the United Kingdom:—1913-14, 22,234; 1919-20, 36 424. The increase is mainly due to the presence of ex-Service students. In the 1919-20 session there were nearly 17,000 ex-Service students in attendance at university institutions in the United Kingdom Of these, rather more than 11,500 were attending institutions covered by the table.—*Daily Telegraph.*

Lecture on Electricity.—An interesting discussion took place at the Rotary Club luncheon at the Grand Hotel, Sheffield, on May 9th, following an instructive paper by Mr. A. E. Jepson, on "The Domestic Uses of Electricity." The speaker laid stress on the importance of the development of electricity for domestic purposes, especially in view of the difficulties which frequently arise with regard to coal supplies. He referred particularly to electric radiators, washers, irons, vacuum sweepers, and toasters, and said that his own experience showed that the cost was less than that of coal and gas, the house was kept cleaner with less effort, and washday became a pleasure. He had even used electricity for heating his fowlhoute, and found that under its influence hens laid earlier and more regularly than was the case ordinarily.—*Yorkshire Telegraph and Star.*

Economy!—As a measure of economy no officials or chairmen of committees of Leigh, Lancashire, are to be sent to any of the annual conferences.—*The Times.*

Electric Battleship Trials.—In a trial test with all four propellers working, the electrically-driven battleship *Tennessee* achieved an average speed of 21 knots. Her engines developed 30,909 h.p. The Trial Board announces that the engines, turbines, and generators worked excellently. The vessel carries 12 14-in. guns mounted in triple turrets.—*Reuter* (Rockland, Me.).

Appointments Vacant.—Assistant officers in charge (£300 +), for the Government wireless stations at Leafield (Oxon.), and Abu Zabal, near Cairo; cable jointer (94s. 1d.), for the Eccles Corporation Electricity Works; charge engineer, for the Bedford Corporation Electricity Department; assistant charge engineer (£309), for the Islington Borough Council Electricity Department; engineer-in-charge (£438), for the Hammersmith Borough Council Electricity Department. For particulars, see our advertisement pages to-day.

Electric Furnaces in America.—The net increase in the number of electric furnaces in the United States last year was 33, as against 36 in 1919, 54 in 1918, 97 in 1917, and 63 in 1916. The total is now 356, as against 323 on January 1st, 1920. The expansion of the industry will be appreciated when it is recalled that there were only 19 furnaces of all types in the United States on July 1st, 1913. In Canada the industry is virtually at a standstill. As heretofore, the Héroult furnace maintains its leadership in installations and output. Most conspicuous in the progress of the American steel industry last year were the Green and Greaves-Etchells types. Expansion in the installation of other types has either been small or absent. A new furnace of small size, but of decided interest and practical use, is the Von Schlegel repelling arc furnace sold by the Industrial Electric Furnace Co., Chicago. Only one of them is operating in the steel industry, but about six are in use in the non-ferrous industry. The Volta furnace, sold by the Volta Manufacturing Co., Welland, Ontario, is an outgrowth of the war, and two are being installed near Pittsburg. The world's steel industry, as a whole, is credited with 961 furnaces, of which the United States and Canada are credited with 399, or over 40 per cent. The numbers of furnaces in the other leading countries are as follows:—England, 150; Germany, 100; France, 69; Italy, 50; Sweden, 50; and Norway, 20.—*Scientific American Monthly.*

Synthetic Resins and Varnishes.—The Electrical Research Association is actively interested in furthering the manufacture and use of electrical insulating materials made from synthetic resins and varnishes, and having the well-known heat-resisting characteristics associated with some of these materials. Leading manufacturers and users of the raw materials and finished products are already co-operating, and it is hoped that persons not already in touch with the work will take an early opportunity of communicating with Mr. E. B. Wedmore, Director and Secretary of the British Electrical and Allied Industries Research Association, 19, Tothill Street, Westminster, S.W. 1.

INSTITUTION NOTES.

Institution of Electrical Engineers.—Return to I.E.E. Building.—The removal of the Institution offices to its own building began on Tuesday, May 17th, and all communications to the Institution should now be sent to Savoy Place, Victoria Embankment, London, W.C. 2. The telephone number will continue to be "Gerrard 764," and the telegraphic address, "Voltampere, Phone, London."

Special Lecture.—On May 26th, at 6 p.m., at the I.E.E. building, Messrs. A. Johnsen and K. Rahbek, two Danish engineers, will lecture on "A Physical Phenomenon and its Application to Telegraphy, Telephony, &c.," and will repeat the demonstrations of their inventions, which, it will be remembered, took place at the Polytechnic Academy at Copenhagen, recently, on the occasion of the centenary of Hans Christian Oersted. The lecturers claim that by sending an electric current through certain substances—such, for instance, as lithographic stone (slaty limestone)—an adherent force, in some respects resembling, but entirely different from, electromagnetism, is produced. The discovery will, it is thought, inspire a series of inventions, both within and outside the field of wireless telegraphy, such as, for instance, greater speed in wireless reception. The lecturers will also give a demonstration of a violin being used as a loud-speaking telephone. A synopsis of the lecture appears on p. 656.

Benevolent Fund.—In order to secure the 19 donations of £250 required to comply with Mr. E. M. Hughman's offer of £250, it has been suggested that some members might be willing to invest that sum in the name of the Fund, subject to their receiving the income during their lifetime; or they might take out fully-paid-up policies on their lives and assign them to the trustees of the Fund.

Annual General Meeting.—On May 31st, at 5 p.m., at the I.E.E. building, the annual general meeting of the Institution will be held to receive and consider the accounts for the year ended December 31st, 1920, and the annual report of the Council, and to elect auditors.

The Charter.—At 5.45 p.m. on the same evening and at the same place a special general meeting will be held for the purpose of considering and, if thought fit, of passing the following resolution, namely:—

"That the Council of the Institution of Electrical Engineers be requested to apply to the Privy Council for a Royal Charter of Incorporation, and that the draft petition and draft charter therefor, which have been initialled for purposes of identification by the chairman of this meeting, be approved, subject to such alterations as the Council of the Institution may deem it necessary or expedient to make therein prior to the application to the Privy Council, and to such alterations as may be made therein by the Privy Council and approved by the Council of the Institution."

Copies of the draft petition and charter have been circulated to members.

Lecture.—At 6.30 p.m. on the same evening and at the same place Dr. F. B. Jewett will lecture on "Research Work in the United States."

Wireless Section.—On May 25th, at 6 p.m., at the Institution of Mechanical Engineers, Mr. C. F. Elwell will open a discussion on "Long-distance Wireless Transmission," and on June 8th, at 6 p.m., in the I.E.E. building, Prof. J. S. Townsend, F.R.S., will read a paper on "Electric Oscillations along Straight Wires and Solenoids."

North-Eastern Centre.—The annual meeting of this Centre was held on May 9th, at Newcastle-on-Tyne, Mr. J. R. Beard presiding. The report of the Committee stated that the membership of the Centre again showed an increase, from 396 to 434.

At the beginning of last session the Committee decided to award annually a local premium valued at £2 2s. for the best paper read by a Student before the Students' Section which is not awarded one of the Institution's Student premiums. Last session the premium was awarded to Mr. L. Champney, for a paper entitled "Wave form of an Alternator." The premium for the closing session has been provisionally awarded to Mr. H. M. Rochester for his paper entitled "Electricity in Mines"; but the award cannot be confirmed until the Council's awards are known. The Committee also decided at the commencement of the session that a further local premium, valued at £2 2s., should be awarded to the Student who made the best contribution to the discussions at the Students' meetings, and this premium has been awarded to Mr. E. T. Jones. The officers and members of Committee for the ensuing year, are:—

Chairman.—Prof. W. M. Thornton, D.Sc.

Vice-Chairmen.—Messrs. E. Fawsett and T. Carter.

Past Chairmen.—Messrs. J. R. Beard, M.Sc., and W. Cross.

Committee.—Power Supply Undertakings.—Messrs. W. F. T. Pinkney, C. Vernier, and A. A. Hughes.

Manufacturers and Contractors.—Messrs. P. F. Allan, A. P. Pyne, H. W. Clothier, N. W. Prangnell, and J. Rosen.

Universities and Technical Colleges.—Mr. W. T. MacCall.

Municipal Engineers.—Mr. E. Moxon.

Consulting Engineers.—Mr. C. H. Davidson.

Civil Service and Railways.—Messrs. F. G. C. Baldwin, G. L. Drury, and H. Kitchen.

Miscellaneous Sections.—Mr. A. C. Michie.

Hon. Secretary.—Mr. H. B. Poynder.

Auditors.—Messrs. C. Turnbull and J. M. Heslop.

Institution of Civil Engineers.—At the annual general meeting, on April 26th, the result of the ballot for the election of officers for the year 1921-22 was declared. The President-Elect is Mr. W. B. Worthington. Amongst the members of Council are Colonel R. E. Crompton, C.B., R.E. (T.); Sir Robert A. Hadfield, F.R.S.; Captain H. Riall Sankey, C.B., R.E. (retired); and Sir John F. C. Snell. The new Council will take office on the first Tuesday in November, 1921.

Royal Photographic Society.—On Tuesday next, at a meeting of the Scientific and Technical Group, by request of the Society, Mr. J. C. Elvy will open a discussion on "Illumination Problems in Kinematography." It is expected that Messrs. Walsh and Buckley, of the N.P.L., and Mr. Priest, of the U.S. Bureau of Standards, will take part.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

At a Mexboro' (Yorks.) Urban Council meeting an animated discussion took place on the question of the salary of the electrical engineer (Mr. J. B. Feltham). In 1919 his salary of £300 per annum was referred to arbitration, the Council and the engineer agreeing to abide by the award. A year later a salary of £660 was awarded. The Council, however, decided that it could not afford to pay such a salary, and it rescinded the agreement to accept the decision of the arbitrators, and offered a salary of £500, which Mr. Feltham accepted without prejudice. The question that now faces the Council is that of the payment to the engineer of £480, representing the difference between £300 and £660 over a period of 16 months, during which time the question of salary was in abeyance. The Council has rejected the Finance Committee's recommendation that the amount be paid, and has also rejected amendments that a smaller sum of £266 be paid, and that the matter be further considered.

Aylesbury Town Council has granted £370 to the electrical engineer (Mr. W. A. Turnbull), as remuneration for work in connection with the installation of additional plant.

Mr. F. Flynn has been appointed acting borough electrical engineer by the Limerick Corporation, with Mr. Grund as acting assistant engineer.

A recommendation by the West Hartlepool Electricity Committee to increase the salary of the engineer to £900 has been rejected.

Mr. George Sutton, who was already an elected member of the Council of the Bribery and Secret Commissions Prevention League, Inc., has been nominated as representative of the Cable-Makers' Association on the Council.

Mr. David T. Wilson, director of William McGeoch & Co., Ltd., announces his retirement, for reasons of health, as from June 30th, 1921. Mr. Wilson has been associated with the firm for close on 40 years as assistant manager, and latterly as director, and is well known in the electrical trade.

Obituary.—Mr. A. G. Newington, M.I.E.E.—We regret to record the death, which occurred on April 30th at Dunfermline, at the age of 49 years, of Mr. A. G. Newington, M.I.E.E., who was on the electrical engineering staff of H.M. Dockyard, Rosyth. The deceased gentleman was a brother of Mr. F. A. Newington, M.I.E.E., city electrical engineer of Edinburgh.

Mr. C. L. Oechsner.—We deeply regret to record that Mr. C. L. Oechsner, publicity manager to the British Thomson-Houston Co., Ltd., at Rugby, passed away on Sunday last at Bournemouth. He had been in failing health for some time. The funeral was to take place yesterday, Thursday.

NEW COMPANIES REGISTERED.

Electric Traction Developments, Ltd. (174,459).—Private company. Registered May 4th. Capital, £4,000 in £1 shares. To acquire and turn to account any patents, licences and concessions relating to (1) railways, tramways and other methods of traction, and (2) and (3) the production, treatment, storage, distribution, application and use of electricity, motive power and lighting and apparatus therefor. The first directors are: T. H. Minshall, 34, Victoria Street, S.W.1, engineer; P. Horsfall, Queen's House, Kingsway, W.C., secretary. Remuneration as fixed by the company. Solicitor: L. H. Booth, Milburn House, Newcastle-on-Tyne. Registered office: 34, Victoria Street, Westminster, S.W.

Scottish Industrial Exhibition, Ltd. (11,712).—Private company. Registered in Edinburgh May 4th. Capital, £500 in £1 shares. To promote and carry on in any part of the U.K. exhibitions of the manufactures, products, industries and material resources of Scotland and of all articles illustrative of science and art, &c. The first directors are: J. Cousin Stevens, 57, Queen Street, Edinburgh, S.S.C.; R. Morrison Ireland, 57, Queen Street, Edinburgh, W.S. Secretaries: Kitchen and Stevens, 57, Queen Street, Edinburgh.

Combination Metallic Packing Co. (1921), Ltd. (174,649).—Private company. Registered May 11th. Capital, £5,000 in £1 shares. To take over the business and certain of the assets of the Combination Metallic Packing Co., Ltd. (incorporated in 1900, and now in voluntary liquidation), and to carry on the business of packing manufacturers, dealers in metallic and other packing, engineers, brass and aluminium founders, forge masters, electric welders, shipping agents, ship repairers and owners, &c. The first directors are: W. M. Brown, 46, Bede Burn Road, Jarrow; G. H. Mackrow, 5, Gordon Terrace, Whitley Bay; W. Matheson, The Clach, Hebburn-on-Tyne. Secretary: G. H. Mackrow. Registered office: Hillgate, Gateshead.

Aylesbury Motor Co., Ltd. (174,646).—Private company. Registered May 11th. Capital, £6,000 in £1 shares. To take over the business of a motor, electrical and general engineer carried on by W. H. Perry at 48 and 50, Kingsbury Square, Aylesbury, Bucks. The first permanent directors are: W. H. Perry, 1, Woodside Avenue, Highgate, N.6; Ellen F. C. Perry, 1, Woodside Avenue, Highgate, N.6; R. R. Gordon Barrett, 48, Kingsbury Square, Aylesbury, Bucks. W. H. Perry may retain office as governing director while holding 1,000 shares, with £250 per annum as remuneration. Registered office: 48-50, Kingsbury Square, Aylesbury, Bucks.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Strand Electric and Engineering Co., Ltd.—Particulars of £2,000 debentures authorised March 11th, 1921, present issue £1,200, charged on company's property, present and future, including uncalled capital.

Woking Electric Supply Co., Ltd.—Issue on various dates from August 7th, 1919, to April 26th, 1921, of £8,070 debentures, parts of a series already registered.

Marston Billington, Ltd.—Debenture dated May 3rd, 1921, to secure £1,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: F. G. W. Pearson, Highlands, Farnham Common, Bucks.

Comac Manufacturing Co., Ltd.—Particulars of £2,000 debentures authorised April 20th, 1921, present issue £700, charged on company's property, present and future, including uncalled capital.

J. E. Lester & Folwell, Ltd.—Satisfaction in full on April 28th, 1921 (a) of mortgage dated August 17th, 1920, securing £1,500, and (b) of equitable charge dated December 13th, 1920, securing all moneys then due or to become due notified. Transfer of mortgage and further charge on 60, London Road, Leicester, dated April 29th, 1921, to secure £8,000, including £3,500 transferred. Holder: Mrs. G. A. Hill, Cedar House, Aylestone Road, Leicester.

CITY NOTES.

Potteries Electric Traction Co., Ltd.

The report shows that the capital expended during 1920 was £22,081, chiefly for additional motor omnibuses. The revenue was £299,929. Traffic and parcel receipts £280,632, or £28,194 in excess of 1919. Expenses increased by £44,261, due principally to increases in wages and to the higher cost of fuel. After deducting all expenses chargeable to revenue, including £11,025 for debenture interest and a provision of £15,000 for renewals, there remains £28,500 (against £44,141 in 1919), plus £12,082 brought forward. There is put to reserve £10,000; 5 per cent. preference dividend, £12,250; dividend of 5 per cent. on the ordinary shares, £12,250; carried forward, £6,082. The reserve will now stand at £110,687, and the renewals fund at £71,319. The increases in wages granted during the year were heavier than during any previous year, and as it was not possible to increase the revenue to the same extent, the balance available for distribution is consequently less. The traffic receipts for the current year were satisfactory until the mines closed down. Considerable competition with the regular services of the company is being experienced at present from motor vehicles, and steps are being taken to meet it. Additional omnibus services have been opened and are providing travelling facilities in districts formerly without adequate means of communication.

Calcutta Electric Supply Corporation, Ltd.

At the annual meeting, held on May 12th, Lord Meston, K.C.S.I., explained how the company's business had developed in spite of the check which Calcutta experienced in its general prosperity during 1920. The demand rose steadily, and 39 millions of units had been sold, as against 32 millions in 1919. Every class of consumer contributed to the increase; the demand for power for industrial purposes rose by nearly 20 per cent., and for private lighting and fans by nearly 25 per cent. In addition to the regular supply the company's staff came to the assistance of Calcutta in October, when the gas strike plunged the city in darkness; for this they received the thanks of the municipality. The expenditure had gone up considerably, due largely to the increased output, but also to a serious increase in the cost of coal, the bill for which rose by over 42 per cent. Wages and salaries had also been increased in view of the high cost of living. The effect of the depreciation of the rupee was not so marked in 1920 as it would be in 1921. But to meet all these adverse circumstances the scale of charges had to be revised and a surcharge of 15 per cent. was added to all consumers other than those with special contracts—to take effect from January 1st. Even with the additions the rates were not only below the legal maximum, but below those charged before the war. Owing to the cheapening of the supply in March, 1920, on a flat rate of 3 annas per unit for domestic purposes other than cooking, the rise in revenue had not been proportionate to the increase in demand. The new increase in rates was but a temporary measure to be abolished as soon as possible. The policy of reducing rates had been fully justified in the past, and in their business the maxim of a large turnover and small profits would probably command their approval, as well as that of the customers. The extensions foreshadowed a year ago had been prepared for, but in view of existing conditions the directors had postponed all capital expenditure which could possibly be allowed to stand over. However, £500,000 of the first mortgage debentures were floated last July, the proceeds enabling the directors to push on with the provision of one 15,000-kW set and one 6,000-kW set with boilers, auxiliaries, and transmission mains. These were still much short of the plant originally contemplated. The directors had written off the whole cost of the recent debenture issue, £24,793, out of the profits, and reserved £83,000 for E.P.D. and other taxation in England. £43,760 had been carried to the depreciation fund, and the reserve and other funds strengthened to the extent of £10,000. The directors proposed a final dividend on the ordinary shares of 6 per cent., with an additional bonus of 1 per cent., making 11 per cent. in all for the year. This is subject to English income tax at the rate of only 3s. 6½d., allowance being made on account of the tax already paid by the company on its profits in India. A bonus of 2 per cent. on the net rupee profits of the company was proposed for the staff in India, who had worked loyally and well in the middle of a local epidemic of strikes and labour unrest. Figures were quoted to show the remarkable progress of the company. Twenty years ago, only 407 houses in Calcutta were supplied with current; the present number was 11,500. The cable mileage rose in the same period from 26 to 525 miles, and the sales of electrical energy from under half a million to nearly 39 million units. And yet the business was capable of almost infinite development in a city like Calcutta, with its steady increase of industrial enterprise and a dense population now breaking through their innate conservatism. The company's position was very sound; there was no need for uneasiness about good Indian investments. The wave of unrest was passing, and the risks attending well employed capital in India were not greater, but probably on the whole less, than under present industrial conditions in England.

The resolution was seconded by Mr. P. V. Luke.

Col. Westrop asked what was the average rate of exchange at which the net profits had been brought home from India, and was informed that it was rather over 2 shillings.

Mr. Lamert commented on the iniquity of the excess profits duty and other taxation. Altogether taxation accounted for about £120,000 out of a revenue of £270,000.

In reply, the chairman agreed that the disappearance of the E.P.D. would benefit the company; but on the other hand, it would mean a higher range of income tax, while there was always the possibility of an extension of the corporation profits tax. Though next year a considerable reduction in taxation might be expected, it was prudent to keep a fair margin for the future. The chairman also raised the point of having a shareholders' register in Calcutta. It was urged that it would be good for the company if Indians and Anglo-Indians were personally interested. The board had considered the matter for some time, and for various reasons had gone slow in that connection, but had now practically decided to open a register in Calcutta.

The resolution was unanimously approved.

At a subsequent special meeting the directors were given additional borrowing powers up to £100,000; and it was agreed to sub-divide the existing £5 preference and ordinary shares into five shares of £1 each.

German Companies.

The accounts of the *Welter Elektrizitats und Hebezeugwerk A.G.*, of Cologne-Zollstock, whose manufactures include lifting appliances, show net profits of 252,000 marks for 1920, as contrasted with 135,000 marks in 1919, and the dividend is at the rate of 15 per cent. and 10 per cent. in the two years respectively.

The accounts of the *Ver. Isolatoren Werke A.G.*, of Berlin, show net profits of 363,000 marks for 1920, as compared with 166,000 marks in the previous year, and the dividend is at the rate of 12 per cent., as in 1919. The report states that the great activity in the first half was followed by a decrease in the demand for insulators and falling prices in the second half of the year.

The directors of the *Accumulatoren Fabrik A.G.*, of Berlin and Hagen, whose share capital was increased from 12,000,000 marks to 20,000,000 marks last year, report net profits of 5,056,000 marks, as against 2,525,000 marks in 1919, and that the dividend rises from 17 per cent. in the latter year to 20 per cent. for 1920 on the larger amount of share capital. The report expresses the hope of a revival in manufacturing, and states that the maintenance of accumulators was being continued in return for additional payments on the part of customers.

The report of the *Sachsenwerk, Licht und Kraft A.G.*, of Dresden, states that the production in 1920 was considerably greater both in value and quantity than in the pre-war year of 1913. It was possible for the Radeberg works, which was acquired from the State, to employ a larger number of men than the 800 originally provided for; the transformer factory at Niedersedlitz was considerably enlarged and the construction of apparatus was extended, while 100,000-volt transmission lines for Saxony and the Reich were being made. The net profits in 1920 were 17,100,000 marks, as compared with 2,160,000 marks, and the dividend is 16 per cent., as against 20 per cent. on less capital in 1919.

Italian Companies.

The report of the *Società Generale Italiana Edison di Elettricità* shows a steady increase in the cost of working, resulting more particularly from the wages increase authorised by the Labriola award, which is, however, counterbalanced in part by the higher tariff granted by Decree No. 2,264. The accounts show a balance of 10,315,584 lire, which allows of a dividend of 36 lire on each of the 240,000 fully paid shares of December 31st, 1919, and of 13.3 lire to 80,000 shares partly paid up. To carry out the installation of new plant, the shareholders have sanctioned the increase of the company's capital from 96,000,000 to 108,000,000 lire, and eventually to 180,000,000 lire by the further issue of 240,000 300-lire new shares.

The report of the *Società Anonima per Imprese Elettriche Conti* refers to the unfavourable conditions created by the Labriola wages award as well as to the increasing dearness of raw materials, which had seriously affected the working of the company. Besides carrying out the works under way at Valdo, plans were being prepared for the installation at Crevoladossola. The accounts disclosed a net balance of 4,905,000 lire, from which a dividend of 22.50 lire to each of the 184,000 old shares and 2.25 to each of the 96,000 new shares would be distributed.

Steady progress marked last year's working of the *Società Elettrica et Elettrochimica del Caffaro*, the accounts closing with a net balance of 909,000 lire, allowing of a distribution of 25 lire to each of the 32,000 250-lire shares. Power was given the directors to increase the capital from 8,000,000 to 12,000,000 lire by the issue of 16,000 new shares. The company has recently secured a concession to develop the Upper Caffaro river, for which the new capital was demanded.

Società Lombarda per Distribuzione di Energia Elettrica.—The report, closing with December 31st last, showed a considerable increase both in the receipts and in the disbursements. The net balance was 3,810,282 lire, which allowed of the distribution of a dividend of 52 lire to each of the 65,000 fully paid up shares.

Società Adriatica di Elettricità (Venice).—The sanctioned increase of the capital to 100,000,000 lire had been carried out, and the augmented demand for energy during the past year had necessitated the resort to the reserve thermic plant. The works for the utilisation of the water power of the Veneto had been carried on uninterruptedly, while those for the more thorough utilisation of the waters of the river Adige by the Milan company were almost completed. The company's operations during 1920 were concerned with the repairs of the lines and plant damaged during the war. The Labriola wages award had imposed heavy sacrifices, having raised the cost of hand labour eight times above that ruling before the war. The accounts showed a net balance of 6,019,224 lire, out of which a distribution of 9 lire per share was declared.

Siemens Bros. & Co., Ltd.—The report for 1920 shows a profit of £253,254, plus £315,776 brought in. The directors recommend a final dividend of 1s. per share, free of tax, making 10 per cent., free of tax, for the year, placing to a special surplus fund £30,000, and carrying forward, subject to excess profits duty for 1918, 1919 and 1920, and to corporation tax, £435,218. It is proposed to increase the share capital from £1,500,000 to £2,500,000 by the creation of ten per cent. cumulative preference shares, to be issued when required, and to capitalise £300,000 surplus assets, to be distributed in the proportion of one ten per cent. cumulative preference shares for every five shares paid.—*Financial Times.*

Mackay Companies.—Receipts of the Mackay Companies for the year to February 1st, 1921, from investments in other companies totalled $4,868,988. Dividends paid absorbed $4,230,330. Operating expenses, including Federal income tax, transfer agents', registrars', auditors' and trustees' compensation, office rent, salaries, stationery, engraving of certificates, &c., totalled $535,400, leaving to be carried forward $103,251. A contract has been signed with Swan Hunter and Wigham Richardson, of Newcastle, for the construction of a new cable repairing steamer to replace present cable ship *Mackay-Bennett*. The new steamer will be completed early in 1922.—*Financial Times.*

Chesham Electric Light & Power Co., Ltd.—The profit for 1920 on electricity supply, after deducting all costs of generation and distribution, and on contracting and other work, was £5,642. Deducting general expenses, rent, rates, &c., leaves £4,332, plus £4,577 brought forward. Debenture and loan interest absorb £1,796, depreciation on property £1,000, balance of cost of debenture issue £302; dividend, £900; balance, £4,910.

Oldham, Ashton & Hyde Electric Tramway, Ltd.—The report for 1920 shows a net profit of £11,500, plus £5,987 brought forward. There is put to reserve £6,000. The dividend on the ordinary shares is 6 per cent. for the year, and £5,987 is to be carried forward. As a result of the arbitration proceedings and subsequent negotiations, the directors have received a definite offer from the local authorities of £125,000 for the system (in addition to the price of stores) and to settle all matters outstanding. The directors advise the shareholders to accept the offer. The amount that will ultimately be available for distribution cannot at present be definitely stated, but there will be a surplus for both classes of shareholders after repayment of the capital.

Constantinople Telephone Co.—After providing for interest on obligations and debt certificates and debiting 5 per cent. interest on share capital, full amount of amortisation, together with reserves for renewals, &c., accounts for year ending December 31st show a loss of £T18,431, which makes a total deficiency of £T74,025.

Craigpark Electric Cable Co., Ltd.—The annual meeting was held in Glasgow on May 12th, Dr. Magnus Maclean in the chair.

New York Telephone Co.—Net earnings for 1920, $12,164,575; deduct interest, $6,094,502; balance, $6,070,073; add surplus at January 1st, 1920, $38,814,111; total, $44,884,184; dividends (8 per cent.), $12,000,000; miscellaneous items, $381,022; surplus, December 31st, 1920, $32,503,162.—*Financial News.*

Anglo-American Telegraph Co., Ltd.—The report is issued for the year ended March, 1921. It states that the four dividend payments announced already absorbed altogether £262,500, being the rent paid by the Western Union Telegraph Co. for the year, equal to 3½ per cent. on the ordinary stock, 6 per cent. on the preferred, and 1½ per cent. on the deferred. The balance at credit of revenue account, £72,158, includes £6,533 interest received, and the balance (£65,625) is available for the payment of dividends for the quarter to March, 1921.

STOCKS AND SHARES.

Tuesday Evening.

With the labour crisis fluctuating daily (if not hourly), the Stock Exchange markets are at some loss to know in which direction the immediate indications point. There was a certain amount of accumulated business to be dealt with after the Whitsun holiday, but as soon as this was cleared off, markets settled down to await developments in the coal trade. Publication of the Railways Bill had an effect surprisingly little upon quotations of stocks and shares in the railway markets. Indeed it may almost be said that the result was practically nil, and the reason may be partially ascribed to the difficulty which the ordinary mind experiences in grappling with the intricacies of the Bill's provisions.

So far as the electric railways are concerned, we have already pointed out that the Bill is not likely to influence their financial position seriously one way or the other. Gorgeous weather at Whitsun caused motor-'bus traffic, in and out of London, to break all records, and this lent fresh courage to those who have been maintaining for some time past that the tube companies are getting into a strong position. As soon as the companies are able to take full advantage of their profit-earning capacities, the shareholders are likely to reap the reward of a long-exercised patience. Because of this, the prices of the various stocks are well maintained on the whole. Though steam stocks may droop, the Undergrounds, with occasional ups-and-downs, manage to hold rises on balance. The enthusiasts are talking about the possibility of a dividend being declared on Districts about the end of next year, though this did not prevent the stock losing 10s. at 16½. Underground Incomes have risen to 74½.

The way in which the prices of new issues continue to advance is remarkable. Central Electric Notes have risen 1½ to 5½ premium. The new City of London Electric second preferences left, it may be recalled, in the hands of underwriters to the tune of about 60 per cent., are now up to 1s. 3d. premium, instead of being 1s. discount, at which the price opened when dealings started. Auckland 6 per cents. have improved to 5 premium. British Oxygen 8 per cent. debentures, which came out at 96, are 4½ premium. Melbourne Electric 8 per cent. preference, now £3 paid, and offered to the shareholders at 4½ for the £5 shares, stand at 3 1/16, while the ordinary shares 5s. paid are 6d. premium. It is expected that when the proposals for the issue of Siemens new 10 per cent. preference shares are passed, and a market opens in the shares, there will also be a premium on these. The meeting to sanction the increase of capital is being held this week, and the ordinary shares, which drooped to 23s. 9d., have recovered to 25s.

Babcock & Wilcox are firm at 2 7/16 on the issue of a report which shows the gross profit of £770,800 to have risen nearly £104,000, and the net profit of £497,468 is £42,500 up on the year. The dividend, which remained at 15 per cent. for five consecutive years, is raised to 16 per cent., the same rate as was paid for the year before the war. It has to be remembered, too, that new capital ranks for dividends this time, and the report speaks of there being a considerable increase in the amount of work in hand, though this is qualified by the statement that new orders are now difficult to obtain, while the coal dispute has caused a cessation in some departments. In these latter considerations, shareholders will find food for reflection that is not altogether palatable, but it must be admitted that the company has had wonderfully good luck and good management in the past decade.

The only change in the home electricity supply market is a rise of ¼ in County of London ordinary, which puts up the price to 7¾. Calcutta Electric Supply shares are better at 5½, and Melbourne preference at 5 are ¼ higher. In the list of manufacturing companies, Edison Swans have given way to 11s. 3d. Electric Constructions at 16s. 3d. are also 9d. down. On the other hand, Metropolitan-Vickers preference at 1 13/16 are ¼ higher, and the market generally is steady.

Montreal Light, Heat and Power shares have improved to 92½. Shawinigan shares at 120 and the 5 per cent. bonds at 113 are both lower. British Columbia Electric preferred at 53½ is down a point, and the Anglo-Argentine Tramways list is

steady at the previous quotations. Mexicans are better as a whole, but the only change in the Utility issues is a dollar rise in the 5 per cent. first mortgage bonds of the Mexican Light and Power Co. Stock Exchange gossip hints at a scheme to be promulgated at an early date under which the arrears of interest on the bonds of the Mexican Utility Companies may be dealt with. Part of the overdue money, according to this report, will be paid in cash and part in Funding scrip. Some such arrangement has been long expected, and the revival of the talk may serve to cheer the fainting spirits of bondholders who have received no interest on their investments for nearly seven years. We give the rumour for what it may be worth; some day, of course, it is sure to materialise. Pharaoh's dream came true of seven fat years being succeeded by an equal period of lean. What happened in the third seven years must present itself as an interesting speculation to holders of bonds in Mexican Utility companies.

Great Northern Telegraphs, with a rise of 25s., and Indo-Europeans, with a rise of 40s., are outstanding features of strength in the market for cable stocks. Eastern ordinary has hardened to 163¼. Westerns are 5s. better at 16¾. Oriental Telephones have picked up to 2 3/16. Marconi's continue steady at 2⅛, but speculation has given place to renewed quietude in the market.

Passing of their dividends by rubber-producing companies is so common nowadays as to arouse no comment. Prices naturally sag. The armament group attracts but mild attention. Prospects of early settlement in the coal trade are canvassed, and, if these fructify, a fall to 6 per cent. in the Bank Rate is held to be inevitable. It is this latter consideration which serves to maintain investment securities at good prices.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1919.	Dividend 1920.	Price May 17, 1921.	Rise or fall.	Yield. £ s. d.
Home Electricity Companies.					
Brompton Ordinary	12	12	6	—	£10 0 0
Charing Cross Ordinary	7	8	8¼	—	10 6 6
do. do. do. 4½ Pref.	4½	4½	5		7 10 6
Chelsea	4	6	9½		9 4 8
City of London	13	14	1..	—	11 16 0
do. do. 6 per cent. Pref.	6	6	17/-	—	7 1 2
County of London	8	8	7⅞	+ ⅛	10 6 6
do. do. 6 per cent. Pref.	6	6	8	—	7 10 0
Kensington Ordinary	7	9	4½	—	10 18 2
London Electric	2½	2½	1	—	7 10 0
do. do. 6 per cent. Pref.	6	6	9⅜	—	10 18 2
Metropolitan	6	7	8¾	—	10 7 4
do. 4½ per cent. Pref.	4½	4½	8..	—	7 7 0
St. James' and Pall Mall	12	12	6	—	10 0 0
South London	6	7	2½	—	9 2 10
South Metropolitan Pref.	7	7	15/9	—	8 17 10
Westminster Ordinary	10	10	6½	—	9 15 2
Telegraphs and Telephones.	1918	1919			
Anglo-Am. Tel. Pref.	6	6	7..	—	7 12 10
do. Def.	33/6	1½	16	—	9 7 6
Chile Telephone	6	6	5½	—	8 6 8
Cuba Sub. Ord.	7	7	7½	—	9 6 8
Eastern Extension	10	10	16⅜	—	6 2 2
Eastern Tel. Ord.	8	10	16..	+1	6 2 4
Globe Tel. and T. Ord.	8	10	16⅜	—	6 2 2
do. do. Pref.	6	6	9	—	6 13 4
Great Northern Tel.	22	22	24	+1½	9 3 4
Indo-European	13	10	32	+ 2	7 16 4
Marconi	2½	2½	2⅛	—	—
Oriental Telephone Ord.	10	13	2..	+ ⅛	*5 13 0
United R. Plate Tel.	8	8	6¾	—	6 10 8
West India and Panama	1/8	Nil	⅛		Nil.
Western Telegraph	8	10	16½	—	*5 19 5
Home Rails.	1919	1920			
Central London Ord. Assented	4	4	45½	—	8 15 10
Metropolitan	1½	1½	23½	— ½	6 17 8
do. District	Nil	Nil	16½	— ½	Nil
Underground Electric Ordinary	Nil	Nil	2⅝	—	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	4	2	74½	+1½	2 18 5
Foreign Trams, &c.	1918	1919			
Anglo-Arg. Trams, First Pref.	Nil	6½	2⅝	—	10 9
do. do. 2nd Pref.	Nil	Nil	8	—	Nil
do. do. 5 % Deb.	5	5	61¼	—	8 2 8
Brazil Tractions	Nil	Nil	34	—	Nil
British Columbia Elec. Ry. Pfce.	5	5	55	—	9 1 10
do. Preferred	2½	5	53½	—1	*3 15 0
do. do. Deferred	Nil	3	51½	—	*11 17 6
do. do. Deb.	4½	4½	58½	—	7 5 4
Mexico Trams 5 per cent. Bonds	Nil	Nil	42	—	Nil
do. 6 per cent. Bonds	Nil	Nil	23½	—	Nil
Mexican Light Common	Nil	Nil	11½	—	Nil
do. Pref.	Nil	Nil	18	—	Nil
do. 1st Bonds	Nil	Nil	69½	+1	Nil
Manufacturing Companies.					
Babcock & Wilcox	15	15	2..	—	6 11 2
British Aluminium Ord.	10	10	10/8	—	12 6 2
British Insulated Ord.	12½	15	1..	—	9 12 0
Callenders	25	15	1½	—	10 0 0
do. 6½ Pref.	6½	6½	17/6	—	7 8 7
Crompton Ord.	10	10	10/8	—	12 6 2
Edison-Swan	10	10	11/8	+9d.	—
do. do. 5 per cent. Deb.	5	5	70	—	7 2 10
Electric Construction	10	10	16/3	—9d.	12 6 2
English Electric	—	8	13/-	—	12 6 2
Do. Pref.	—	6	14/6	—	8 5 6
Gen. Elec. Pref.	6½	6½	19/-	—	6 14 10
do. Ord.	10	10	22/9	—	*8 8 0
Henley	25	15	1..	—	10 6 8
do. 4½ Pref.	4½	4½	8½	—	6 13 6
India-Rubber	10	10	½	—	—
Mat.-Vickers Pref.	—	8	1½	+ ⅛	8 16 10
Siemens Ord.	10	10	1½	—	*5 0
Telegraph Con.	20	20	20½	—	*5 12

* Dividends paid free of Income-Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, May 17th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	10d.	..
a Ammoniac Sal	per ton	£75	..
a Ammonia, Muriate (large crystal)	"	£65	..
a Bisulphide of Carbon	"	..	..
c Borax	"	£34	..
a Copper Sulphate	"	£38	..
a Potash, Chlorate	per lb.	6d.	..
a " Perchlorate	"	8d.	2d. dec.
a Shellac	per cwt.	£19 10s.	£3 inc.
a Sulphate of Magnesia	per ton	£16	..
a Sulphur, Sublimed Flowers	"	£19	..
a " Lump	"	£18	..
a Soda, Chlorate	per lb.	3d.	..
a " Crystals	per ton	£7	..
a Sodium Bichromate, casks	per lb.	5d.	..
METALS, &c.			
p Babbitt's Metal Ingots	per ton	£95 to £300	..
c Brass (rolled metal 2" to 12" basis)	per lb.	11½d.	..
c " Tubes (solid drawn)	"	1/1½ to 1/2	..
c " Wire, basis	"	1/3d.	..
c Copper Tubes (solid drawn)	"	1/3½	..
c " Bars (best selected)	per ton	£114	£1 dec.
c " Sheet	"	£114	£1 dec.
c " Rod	"	£114	£1 dec.
d " (Electrolytic) Bars	"	£75	..
d " " Sheets	"	£145	..
d " " Wire Rods	"	£89	..
d " " H.C. Wire	per lb.	1/-	..
f Ebonite Rod	"	3/6	..
f " Sheet	"	8/-	..
a German Silver Wire	"	2/9	..
h Gutta-percha, fine	"	14/- to 16/-	..
h India-rubber, Para fine	"	10½d.	..
l Iron Pig (Cleveland Warrants)	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£40	..
g Lead, English Pig	"	£25	£1 10s. inc.
g Mercury	per bot.	£11 5 to £11 10	..
e Mica (in original cases) small	per lb.	4d. to 4/-	..
e " " " medium	"	5/- to 10/-	..
e " " " large	"	12/6 to 25/- & up	..
p Phosphor Bronze, plain castings	"	1/4 to 1/9	..
p " " rolled bars and rods	"	2/1 to 2/6	..
p " " rolled strip & sheet	"	2/3 to 2/7	..
d Silicium Bronze Wire	per lb.	1/3½	..
r Steel, Magnet, in bars	"	1/8	..
m Tin, Block (English)	per ton	£178	£11 to £12 inc.
n " Wire, Nos. 1 to 16	per lb.	4/-	..
p White Anti-friction Metals	per ton	£78 to £300	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
m Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
p ——
r W. F. Dennis & Co.

British Engineering Standards Association.—A conference, unofficial in character, of the secretaries of the various standardising organisations at present in existence, has recently been held in London. The conference was opened by the chairman of the Association, Sir Archibald Denny, Bart.

The following secretaries were present:—Dr. P. G. Agnew (U.S.A.), Mr. J. R. Durley (Canada), Mr. A. Eriksen (Norway), M. G. Gerard (Belgium), Mr. E. Hijmans (Holland), M. Zollinger (Switzerland), and Mr. C. le Maistre, C.B.E. (Great Britain).

Each secretary gave a brief report of the general organisation of the work in his own country, the methods adopted in arriving at the standards, as well as the principles followed to ensure their adoption when issued. It is interesting to note that in most countries it is becoming more and more recognised that industrial standardisation, whether of quality or dimensions, to be really useful must be arrived at through a process of unifying the needs of industry rather than by attempting to set up an ideal. It also appears that whereas engineers are everywhere giving freely of their time and experience to this important work, its value to commerce generally is far too little appreciated, and it is, therefore, not being supported financially to the extent it should be.

The conference preferred to see international standardisation develop along national lines, and sectionally, similar to those adopted for instance by the electrical industry in the case of the now well-established International Electrotechnical Commission. Each secretary will, in due course, submit to his respective organisation the suggestions of the conference on the various points discussed.

The secretaries were entertained by the British Engineering Standards Association during their four days' conference.

Assistant Examiners in the Patent Office.—The open competitive examination will begin on Tuesday, July 26th, instead of on Tuesday, July 12th (as stated in the printed regulations) and will last until Saturday, July 30th. Any candidate who has attained the age of 20 on July 26th, 1921, and has not attained the age of 25 on July 12th, 1921, will be regarded as eligible in respect of age to compete on this occasion.

SUBMARINE CABLE TELEGRAPHY.

Oscillatory Circuit Signal Conditions: Some Graphs, Tables, and Scales.

By EDWARD RAYMOND-BARKER.

(*Concluded from page* 630.)

52. Expressions 42 and 45 may be used for the plotting of corresponding curves, for calibration of scales, or—as has been seen—for compilation of tables. The various curves in the following series (considerably reduced from originals) happened to be called for in connection with trials over laid cables, and for laboratory purposes. Judging from reports received, these curves have proved their value. They are reproduced here, on a necessarily much reduced scale, as examples of a few out of very many ways in which these matters may be treated graphically.

53. A pair of compasses, or a paper straight-edge and pencil marks, may conveniently be used in deriving data from these curves.

54. Fig. 8 shows K, in microfarads, suitable severally for L of 2, 3, 5, and 10 henries, at various speeds in *l.p.m.*

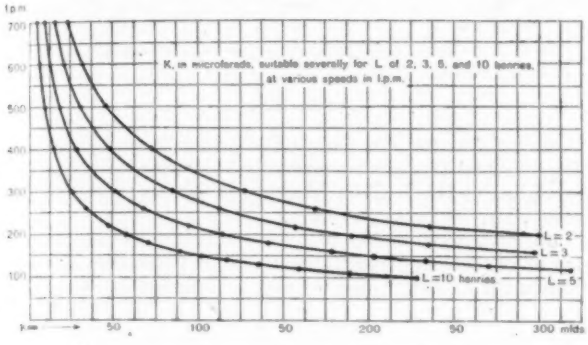


Fig. 8.

Example.—At a signalling speed of 300 *l.p.m.*, and with an inductance shunt of 10 henries, a receiving condenser of 25 mfd. ought to be used. Checking by actual figures (see 45),

$$K = \frac{1}{10}\left(\frac{4{,}774{\cdot}7}{300}\right)^2 = 25{\cdot}3 \text{ mfd.}$$

55. Fig. 9, electrically, is the same as fig. 8, but is on a

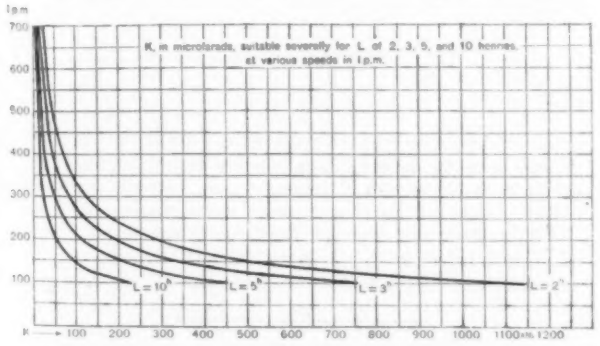


Fig. 9.

smaller scale in order to show more extensively, over a given space, the general trend of the curves.

56. Fig. 10 shows L in henries suitable severally for K of 5, 10, 15, and 20 mfd. at various speeds in *l.p.m.*

Example.—At a signalling speed of 180 *l.p.m.*, and with a receiving condenser of 20 mfd., an inductance shunt of just over 35 henries ought to be used. (The curve shows this at a glance). Checking by actual figures (see 42)

$$L = \frac{1}{20}\left(\frac{4{,}774{\cdot}7}{180}\right)^2 = 35{\cdot}2 \text{ henries.}$$

57. Fig. 11, electrically, is the same as fig. 10, but is on a smaller and more extended scale, showing the general trend of the curves.

58. Figs. 12, 13 and 14 constitute valuable graph-records of K and L relativity severally for signalling speeds of (fig. 12) 150, 175 and 200 : (fig. 13) 300, 400 and 500 : (fig. 14) 600, 700 and 800 *l.p.m.*

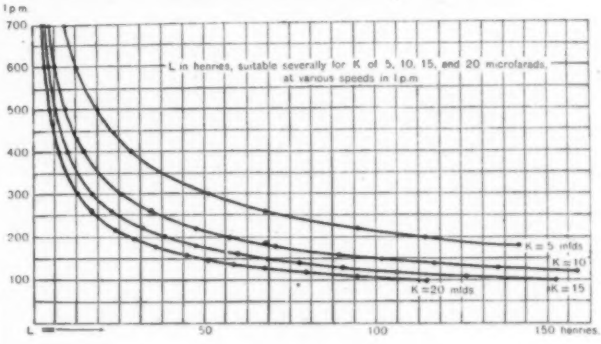

l.p.m.
L in henries, suitable severally for K of 5, 10, 15, and 20 microfarads, at various speeds in l.p.m.
K = 5 mfds.
K = 10
K = 20 mfds.
K = 15
L
150 henries

Fig. 10.

59. Table V affords an example of one out of innumerable ways in which the foregoing curves may be used for calibrating speed scales for any required purpose.

The three calibrated (K) scales shown in Table V were taken from the three curves in fig. 12. These scales, of

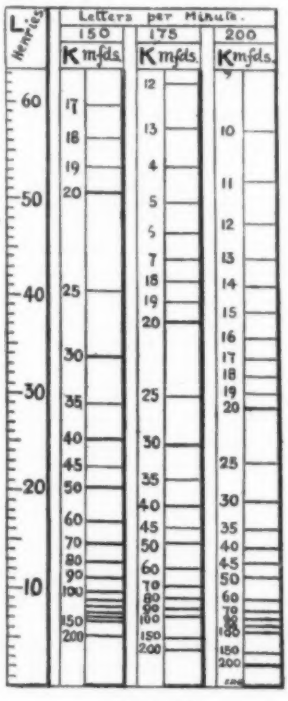


Table V.

course, might have been calibrated directly by calculation, and not by means of preliminary curves.

60. A straight-edge extended horizontally from any given reading (on L scale) in henries, will indicate on the three K scales the microfarads necessary for these three signalling speeds. The number of scales thus built up, and included in an extended series, may be continued at pleasure.

61. Before concluding, let us revert, for a moment, to the oscillatory circuits of reception respectively in simplex working and in duplex as shown in figs. 5 and 6. Inspection of these two diagrams discloses the fact that

there is nothing novel in these connections and general electrical arrangement as portrayed in the two diagrams in question. Electrically—similar diagrams are to be found in Patent Specifications of more than 20 years ago, *e.g.*, the British Specification 12,731 of the year 1898, due to the late Dr. Alexander Muirhead, F.R.S. Invaluable matter of cognate nature, also, is to be found in the British Patent 1,434, of 1899, emanating from Mr. S. G. Brown, F.R.S. Cable telegraphy owes much to these two distinguished investigators.

62. However, notwithstanding this apparent sameness, the fact is that only in recent years has the actual nature of the problem of high-speed cable transmission and reception

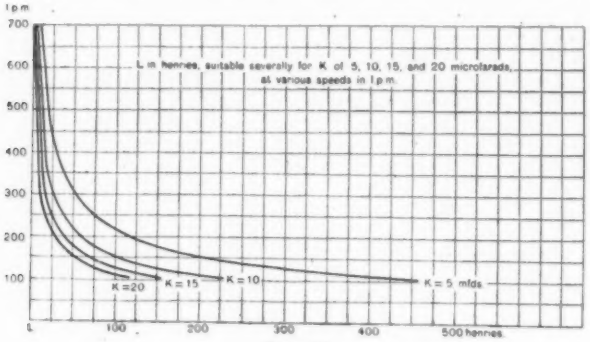


FIG. 11.

been perceived, and the necessity realised as to bringing about correlative conditions with regard to transmitting frequency, and reception *natural* frequency as referred to in 7.

63. In the first afore-mentioned Specification (Muirhead's) the student is shown how the inductance coil L can be varied readily in relation to the capacity K of the receiving condenser employed; and how, when the receiving instrument and condenser are shunted by an inductance L, more sudden changes are attained in the circuit of the receiver which, by the way, at the present day, is invariably

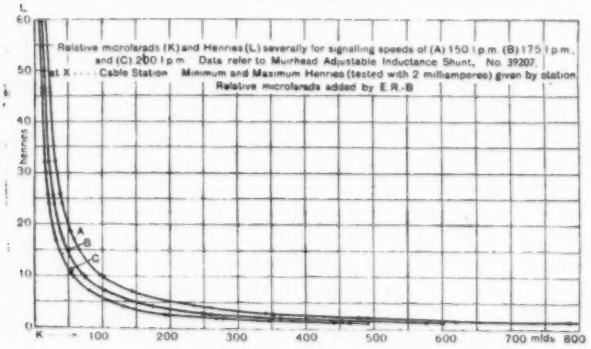

Relative microfarads (K) and Henries (L) severally for signalling speeds of (A) 150 l p m. (B) 175 l p m. and (C) 200 l p m. Data refer to Muirhead Adjustable Inductance Shunt, No. 39207.
Cable Station. Minimum and Maximum Henries (tested with 2 milliamperes) given by station.
Relative microfarads added by E.R.-B
A
B
C
K
100
200
300
400
500
600
700 mfds
800

FIG. 12.

an amplifier. Thus, all initial impulses of received current flow through, and affect, the receiving instrument, while subsequent steady current is shunted off to earth through the self-inductance L.

64. In connection with the second specification before referred to (Brown's), one is shown how the resistance of the magnetic shunt (or heavy inductance) L is much less than that of the receiving instrument. For instance, the resistance of the former may be, say, 30 ohms, and that of the latter, say, 500. The result, according to the inventor, is that all slow impulses flow through L, leaving the receiving instrument unaffected, while all sudden impulses, such as the line signalling currents, are resisted by the choking action of the iron-cored inductance L, and, therefore, are free to affect the receiving instrument. Also any varying zero, such as is due to slow irregular currents, is thus prevented, maximum signal-definition is attained, signal efficiency is thereby enhanced, and speed increased.

65. In spite of all this excellent work done more than 20 years ago, it was much later on that the close relationship, or rather, relativity which, in a truly coherent signalling system, must exist between transmitted-signal frequency, and the *natural* oscillation frequency of the receiving apparatus (as already expressed in 7) was at length recognised and taken into account. The present writer is unable to state from actual knowledge, to whom,* personally, this advance in applied electro-physics has principally been due, but the fact is clear that much light has been thrown on these matters by Dr. H. W. Malcolm in his book already referred to. Also, invaluable investigation work, under the enlightened *régime* of progressive electricians-in-chief, has

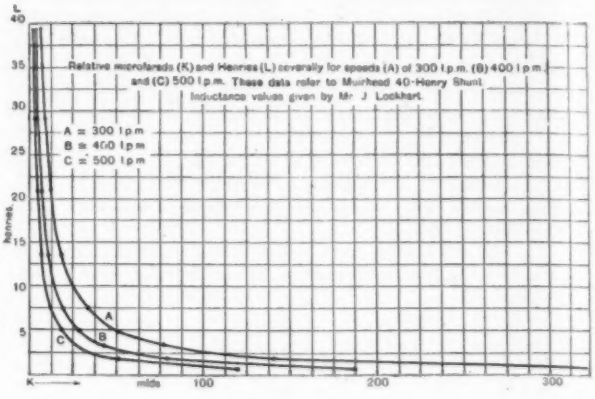

Relative microfarads (K) and Henries (L) severally for speeds (A) of 300 l p m. (B) 400 l p m. and (C) 500 l p m. These data refer to Muirhead 40-Henry Shunt.
Inductance values given by Mr. J. Lockhart.
A = 300 l p m
B = 400 l p m
C = 500 l p m
henries
A
B
C
K
mfds
100
200
300

FIG. 13.

been carried on for years past by the Eastern Telegraph Co.'s Experimental Department successively by such well-known specialists as Mr. J. Elton Young, and by his present successor, Mr. Benjamin Davies.

66. In conclusion, the writer lays no claim to have done more here than to touch the fringe of one particular section of technics relating to the working of long submarine tele-

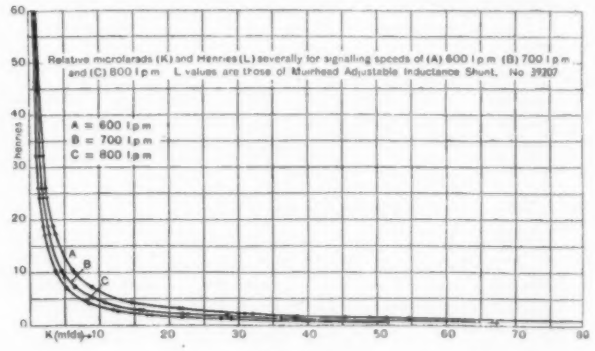

Relative microfarads (K) and Henries (L) severally for signalling speeds of (A) 600 l p m. (B) 700 l p m. and (C) 800 l p m. L values are those of Muirhead Adjustable Inductance Shunt, No. 39207.
A = 600 l p m
B = 700 l p m
C = 800 l p m
henries
A
B
C
K (mfds)
10
20
30
40
50
60
70
80

FIG. 14.

graph cables under modern conditions. All he has tried to do has been to deduce, from already-known methods, an easily workable system of tables, graphs, and scales as best suited to time-saving requirements of telegraph-cable men.

[We understand that Mr. Raymond-Barker has received additional information of great interest, which will be embodied in a supplementary article.—EDS. ELEC. REV.]

British Traders in Australia: A Protest.—According to the *Daily Mail*, British traders are raising a protest against an Act passed by the Australian Government known as the "Who Are You?" Act. Agents for British goods in the Commonwealth now have to furnish details of the total capital of the firms they represent, a list of directors, and a profit and loss account, and answer a long list of questions which have no bearing on the goods they sell. The Colonial Office is to be approached to see if British firms can be excluded from the provisions of the Act.

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* In all probability Kay Oscar Arthur Gulstad, of the Great Northern Telegraph Co., of Copenhagen, was the first to devise, and produce over a submarine cable circuit, instrumental oscillatory synchronism between current-impulse transmission and reception. See description of the Gulstad Vibrating Cable Relay in the ELECTRICAL REVIEW, June 3rd and June 10th, 1898, also August, 1902, and, lastly, Mr. Walter Judd's concise little monograph on the same subject in the ELECTRICAL REVIEW of March 27th, 1914.—E.R.-B.

THE PRESENT ECONOMIC POSITION OF THE ENGINEERING AND ALLIED INDUSTRIES.

(*Continued from page* 610.)

The Influence of Taxation.

When introducing his Budget in April, 1920, the Chancellor of the Exchequer evidently failed to realise that the causes which had stimulated the boom in trade were beginning to fail. Counting unjustifiably on a continuance of the boom, he naturally sought the opportunity to obtain as great a revenue as possible, for the purpose mainly of reducing our debt abroad and that form of debt at home known as the "Floating Debt."

Economically these added to our burden and aggravated the financial stringency, and therefore contributed to the present situation.

In the case of the Excess Profits Duty (a tax imposed for the very proper purpose of preventing, so far as might be possible, the accumulation of huge profits out of the nation's necessity) the trouble was that account was not taken of the changed value of money, and profits were described as excessive, which in purchasing value were frequently below the pre-war level, and in consequence the supply of new capital for the maintenance and development of industry was diverted to other purposes, and the financial stringency reached such a pitch that, in combination with the other causes already described, a slump became inevitable.

The Particular Case of the Engineering and Allied Industries.

As between a period of good trade and bad trade, the business of a baker may only fluctuate by as little as 10 per cent., whereas to-day there are engineering firms which are obtaining no orders at all, and in some cases whole branches of the industry are only receiving orders equal to one quarter (or less) of their productive capacity.

During the present crisis cancellation and suspension of orders have taken place and are still taking place to a very serious extent, and in consequence the slump in employment has been more rapid and more serious than on any previous occasion.

How the Burden of Unemployment is Eased.

By manufacturing for stock, employers help to reduce the volume of unemployment, and, at the same time, by preserving their productive organisation, they are better able to take advantage of the trade revival when it comes.

Moreover, by keeping men at work, even if short time has to be worked, the moral and physical deterioration which prolonged unemployment causes is prevented.

Manufacturing for stock, however, is limited to certain trades and does not much affect the general position.

Further, where it is customary for manufacturers to make for stock they are unable to face the loss which would be incurred by having to dispose of stock made at the present high cost of production.

No Conspiracy to Reduce Wages.

It is unfortunate that in certain quarters it should be alleged that employers have entered into a conspiracy, having for its object the forcing down of wages.

Every employer is doing all in his power to obtain all the orders possible.

While employers, in order to lower the price of their products with a view to stimulating demand, are unanimous in their view that reductions in wages are essential, this does not imply a desire to lower the standard of living, and they are equally unanimous in hoping that the fall in rates of wages will be balanced by a fall in the cost of living, just as rapid, if not more rapid. On the other hand, none can predict with certainty what will happen over any particular period, and some change in the standard may be inevitable. The only permanent remedy for such change is increased individual output.

The Effect of the Moulders' Strike.

It is impossible to overlook the disastrous effect of the moulders' strike.

This came at a time when there was a world-wide demand for goods.

The strike interfered with deliveries, not only while it lasted, but for long after, and it occasioned financial losses far in excess of the actual loss of foundry production, because the indirect loss of production in other departments was greater than in the foundries themselves, while during its progress many orders were diverted to other countries.

The strike gravely weakened the ability of industry to stand up against the present slump, and was probably the heaviest blow ever struck against industry.

Cost of Coal Production.

The influence of wages on cost is well illustrated in the case of coal production.

The following official figures for January are of interest:—

	Per ton of coal disposable commercially.
Wages	31s. 7.01d.
Stores, timber, &c.	5s. 6.41d.
Other costs (management, salaries, insurances, repairs, office, selling and general expenses, &c.)	2s. 8.21d.
Royalties	7.80d.
Total cost	40s. 5.43d.
Deduct proceeds of miners' coal ...	2.41d.
Net cost	40s. 3.02d.

In this case it will be noticed that wages constitute just over 78 per cent. of the total cost of production.

In 1913, the average pit-head price per ton sold was 11s., while to-day £5,000,000 a month is being lost despite the fact that it is being sold at a price three times as high.

The wages per ton in 1913 were 6s. 4d., while now (March, 1921) they are about 25s. a ton, *i.e.*, nearly four times as high. In 1913 wages were about £7 10s. a month and now they are about £17 10s., or about 135 per cent. higher.

The difference between the 300 per cent. increase in the wages per ton and 135 per cent. increase in the wage per worker is due to the appalling loss of productivity.

Cost of Engineering Production.

Owing to the complexity of engineering production, statistics as simple as those for coal mining cannot be obtained for the engineering industry.

With the help of the census of production of 1907, it is possible to show the cost for the whole engineering and shipbuilding industry for a normal pre-war year of good trade.

The average number of wage earners at work on four selected days was 1,432,489, in addition to 106,926 salaried employes.

The selling value of the whole production was £375,196,000, the value of the materials used was £212,224,000, and the value of the work given out to other firms to do was £9,880,000. This last item is counted twice over, first in the return of the firm which did it and then in the value of the finished work of the firm which gave it out, so that the real total production was £365,306,000. Deducting the value of the materials used, the whole of the work done by the two industries was £153,082,000.

Now in 1906, when the last inquiry of wages took place, the average earnings for all the men, women, boys or girls in the two industries was 27s. 4d. a week.

Trade was rather better in 1907, so the average in that year was approximately 28s.

As the figures for those at work exclude all who were absent due to unemployment or sickness, we can take the total average earnings for the year for the 1,432,489 persons counted as the earnings for every week except for days when works were closed for holidays, *i.e.*, for, say, 50 weeks.

This gives an average income of £70 a year, or a total wage bill of about £100,270,000, leaving for the salaries of 106,926 staff employés (managers, draughtsmen, foremen, clerks, &c.) for all depreciation, insurances, rent, rates and taxes, power, lighting, heating, oiling, painting, maintenance, upkeep of small tools, depreciation, and other management expenses, and also for profits, the balance of the £153,082,000, namely, £52,812,000.

Wages thus absorbed 65.5 per cent. of the value added to the materials used, while staff salaries, all the almost innumerable overhead expenses referred to above and profits, represented 34.5 per cent.

It has to be kept in mind that dividends are paid out of profits, and if satisfactory dividends to the millions of shareholders are not available, capital will not be furnished for industry.

There is no reason to believe that the position was materially different just before the war.

It is evident that profits alone represented but a small percentage of turnover even though in the aggregate a large sum. Two very large firms, which published information on the subject relating to the year 1918, showed proportion of wages to profits of about 10 to 1 in one case and about 12 to 1 in the other.

Foreign Competition.

The United Kingdom is not and cannot be a self-contained unit.

It is dependent upon the outside world for half its food, all its raw cotton, more than half its wool, all its non-ferrous metals except some tin and lead, for all its rubber, and most of its oil, to say nothing of innumerable other materials.

It can only pay for this if it can sell abroad that surplus of its coal and of its manufactured products for which it has no market at home.

The 1907 Census of Production showed that nearly one-third of its total industrial output was sold abroad.

Unless we can maintain our overseas markets, one-third of our industrial labour must be idle, even if we could somehow obtain the materials on which to employ the remainder.

Productivity of Labour.

The great misfortune is that at present, for a variety of reasons, the productivity of British labour is below its pre-war standard, and below that of workmen in competing countries.

It was hoped that the reduction of hours by the improvement of the physical conditions of manual labour would have led to a much higher output per hour so as to compensate for the loss of productive hours.

Up to now this desirable change has not materialised.

If output per hour is high, there is no inconsistency between high earnings per hour and a low wage per piece.

If the foreign exchange position were normal, if the burden of taxation were not inevitably so high, even apart from any increased burden due to extravagance, real or alleged, on the part of the Government, it might be possible to overcome our difficulties by increased productivity, but with all the disadvantages under which we are working, employers are regretfully forced to the conclusion that this is not sufficient and that there must also be a reduction of wage rates.

Coal, Wages, &c., and Cost of Production.

The influence of the price of coal on the cost of engineering production is of the highest importance. In the case of steel about four tons of coal are used to produce a ton of steel in the ingot.

With coal wages about 19s. a ton higher than in 1913, this alone adds practically £4 a ton to the price of steel before it reaches the stage of the plate, the bar, or the forging.

When, however, there are added the increased wages in steel represented by the increased wages of railwaymen, which shows itself in the higher railway rates on coal, coke, pig iron, iron ore, limestone, &c., another large element is added to the price of steel. (Note.—Railway wages were about £47,000,000 a year in 1913; they are about £173,000,000 to-day.)

Further wage items in steel are contained in the increased wages of the iron ore miners, the blast furnacemen, the limestone workers, and so on.

Then last of all we have the enormously enhanced wages of the steel workers themselves.

A complete analysis of the ultimate cost of producing a ton of steel would show that 80 to 90 per cent. was wages and 20 to 10 per cent. was salaries, profits, and taxation.

Necessity for Immediate Action.

It may be said that the "consumers' strike" will collapse and that foreign exchange will improve; that the financial stringency will pass, and so no reduction in the cost of production is needed.

All past experience is conclusive that the reaction from a slump is stimulated most promptly by a reduction in selling prices.

The inflation of prices has been so great and the present level of prices at which orders can be obtained is so much lower than the high level on the basis of which wages were advanced to the present height, that the needed reduction in price is something far in excess of the employers' margin of profit, even taking into account the relief which will come with cheaper coal and steel following or accompanying lower coal and steel wages.

The alternative to reduction now is a vast increase in unemployment owing to inability to obtain orders at present prices.

It has to be kept in mind that if a reduction in wages takes place there is ample opportunity for workmen, by an increase in output, to increase their earnings to such an extent as will greatly, if not entirely, compensate for reduction in wages rates.

The workman quite naturally and properly seeks the highest weekly income the industry can afford. The employer, who has to find a market for the products of the joint efforts of himself and those he employs, seeks the lowest cost per article that every aid to production can afford.

Conclusion.

The only ray of hope at the moment is that there are signs of an easing of the financial stringency. The National Debt has been reduced by nearly 230 millions since April, 1920, and the total reduction by the close of the financial year may reach a considerably higher figure.

The Chancellor of the Exchequer is of the opinion that Treasury Bills will now be received in sufficient quantities at 6 per cent. instead of the rate of 6½ per cent. which has been in force for the last eleven months.

This will help manufacturers somewhat in their efforts to reduce the cost of production.

It is hoped that this statement is as fair and as reasonable as it is possible to make it.

There has been no conscious seeking for dramatic effect, but only a straightforward effort by the employers to disclose to their workshop colleagues in the industry, those facts with which an employer, from the nature of his work, is brought into constant touch, but which facts are often unknown to the worker in the shop though bound vitally to affect him eventually.

For over 20 years the engineering industry has been able to solve its difficulties by a frank exchange of views, and in the belief that the greatest difficulty it has ever faced can only be solved in the same way, this document has been prepared as an effort to present a comprehensive and reasoned statement of the case, and thereby secure the co-operation of workpeople in bringing about the changes necessary to overcome the difficulty.

At different points throughout this statement the necessity of decreasing the cost of production has been emphasised.

It is the considered opinion of the employers that a definite reduction in hourly rates and an increase in individual output are both necessary. The effect of the reduction on the standard of life will depend on the fall in the cost of living and the extent to which the workpeople maintain and increase their actual earnings by a greater intensity of output.

Here follows an appendix of the highest importance, giving "Chapter and Verse" as to the recent vast loss of orders directly due to high costs of production, in connection with marine, agricultural, locomotive, machine tool, electrical, textile, motor, colliery, chemical, and general engineering, for which we must refer our readers to the original text.

Below we commence an abstract of the reply of the Amalgamated Engineering Union to the foregoing statement.

The reply first quotes the dividends of a number of British engineering firms for the year 1920 and the Stock Exchange prices of shares in engineering companies at April 1st, 1921. The object is to show that "British engineering firms have not been doing so badly." The writers continue:—

As a matter of fact the volume of British engineering exports during 1920 compares very favourably with that of the booming year, 1913. Here are some comparative export figures:—

	1913.	1920.
Machinery	£33,602,474	£63,457,937
Electrical apparatus	5,386,273	11,600,386
Scientific instruments ...	2,056,417	3,144,779
Implements and tools ...	2,796,538	6,837,540
Cutlery	836,129	1,897,248
Iron and steel manufactures, viz:—		
Anchors and cables ...	687,207	2,010,863
Bedsteads	747,514	1,585,808
Hollow ware	1,066,975	3,059,952
Others	4,849,055	8,247,589

If it be said that the demand has now ceased, it may be pointed out that the exports for the month of February, 1921 (the last available), were still on much the same scale. Cutlery was twice what it was in February, 1913; implements and tools, twice as much; scientific instruments, one-third more; electrical apparatus, nearly three times as much; and machinery generally, £6,397,929, as against £2,471,994. Not so bad!

The Foreign Exchanges.

The employers' pamphlet (which quotes no Stock Exchange prices, and names no dividends) starts off with an elaborate disquisition on the evil complications of the foreign exchanges—a subject, by the way, which the average manufacturer understands as little as the average workman. The disquisition may be simply disregarded. It is an impudent attempt to create a bogey by mystification. . . . But no prospect is allowed to alleviate the woe of the writer of the pamphlet. He sees nothing but obstacles to business whether the rates of exchange are favourable or adverse. At present it is the currency of France and Germany, Poland and Russia, and Italy and the Balkans which is depreciated, so that the equivalent in native money of a pound sterling is very high. This is represented as seriously discouraging the export of engineering products to these countries. What the writer does not mention is that exactly the opposite state of things prevails in the United States and Canada, India and Chile, Argentine and Uruguay, Holland and Portugal, and Sweden and Switzerland. With these countries the rates of exchange are low, and it is not the native currency but the pound sterling which is at a discount. If the rates of exchange are discouraging our exports to France and Germany, Poland and Russia, and Italy and the Balkans, in exactly the same way the rates of exchange are positively stimulating and facilitating our exports to the United States and Canada, India and Chile, Argentine and Uruguay, Holland and Portugal, and Sweden and Switzerland. But the writer of the pamphlet ignores this. He even claims to have it both ways, blaming, for the failure to make export sales, first the high rates of exchange with Germany, and then the low rates of exchange with India, where there has been such an orgy of imports (largely of engineering products) from this country that there is a temporary congestion of stocks!

It is unnecessary to pursue the matter further. Whilst the social and economic conditions of other countries are of the greatest importance to our trade, and the adoption of a wise and humane policy in foreign affairs is therefore imperative, members of the A.E.U. (or their employers) need concern themselves no more about the rates of exchange than about the readings of the barometer. Those who wish further explanation of the subject may study the able Memorandum printed as Appendix I.

(To be continued.)

MAGNETOS FOR INTERNAL-COMBUSTION ENGINES.

Discussion in London.

(*Concluded from page* 633.)

Mr. A. P. Young explained that it had always seemed to him that the h.p. magneto was one of the most interesting and complicated pieces of apparatus to be found in the whole range of electrical appliances.

The armature was usually only 2 in. in diameter; it comprised some 200 turns of primary winding and from 9,000 to 10,000 turns in the secondary. The voltage generated each time the primary winding was open circuited might reach a maximum value of 11,000. Magnetos had been built to give over 250 distinct sparks per second, so from the standpoint of voltage alone the problem of satisfactorily insulating the secondary winding was quite complex, and analogous in many respects to the general problem of insulating high-voltage electrical machinery, but obviously made more difficult by the very small space occupied by the windings. Prof. Taylor Jones's mathematical treatment of the magneto showed that high-frequency oscillations occurred in the secondary circuit, which came

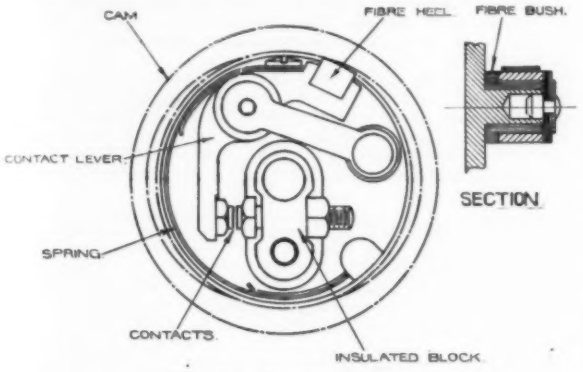

Fig. 11.—Contact Breaker.

within the range of wireless frequencies. In fact, one of the problems which had to be faced in connection with the installation of magnetos on aeroplanes fitted with wireless apparatus was the prevention of interference that might arise from high-frequency oscillations in the h.p. circuit of the magneto. A detailed consideration of the magnet's function, and the relationship between the magnetic characteristics of the steel and the electrical performance of the magneto, became a very complex problem. Such a study covered the whole range of permanent magnetism, whilst an inquiry into the influence of the composition of the steel, hardening temperature, &c., on the magnetic characteristics led one into the realms of metallurgy. The contact breaker was, perhaps, the most wonderful part of a magneto. A study of its operation

magnetos. The limits of accuracy were necessarily very fine—much smaller than in any other class of electrical apparatus. For example, the air gap between the armature and pole pieces was usually about 0.005 in., a limit of only ± 0.001 in. being allowed. For a certain type of multi-cylinder aero magneto manufactured during the war period no less than 720 gauges were necessary. That particular magneto had in its composition 400 parts of different design, the total number of parts being 860. The finest limit of accuracy worked to was a tolerance of 0.0003 in.

Fig. 11 illustrated the type of contact-breaker construction used on the orthodox rotating-armature type of magneto. A little steel spring-controlled contact arm was free to oscillate on an insulating bush usually made of fibre, such oscillation being imparted to the lever by virtue of the fibre heel attached to one end of it coming in contact with an annular cam which surrounded the revolving unit. The maximum gap between the contacts was only 0.012 in., but although the movement was so small, the forces that were brought into play at high speeds became relatively great. Figs. 12 and 13 showed curves which related to the relatively short period of time during which the contacts were opening, on the assumption that the heel and cam profile were such as to impart harmonic motion. The point of special interest was that at the moment of impact the acceleration was a maximum (see fig. 12 and, in consequence, the pressure between the heel and the cam at that moment, which was equal to the spring pressure, plus the force required to impart that acceleration to the lever, also reached a maximum. When operating at high speeds, the acceleration component of the force greatly exceeded that due to the spring pressure, and in a certain design of four-cylinder magneto that acceleration force might reach seven pounds at a speed of 3,000 r.p.m. On a multi-cylinder aeroplane magneto that the speaker designed during the war period, the acceleration force was as much as 14 pounds.

The phenomenon of contact arcing opened up wide fields for further research and investigation, because it was doubtful whether that phenomenon was clearly understood even at the present time. Mr. Watson suggested that the theory of sparking voltages which had been put forward in an attempt to explain what happened at the moment of separation of the contacts was hardly compatible with the theory of arcing. It was perfectly true that local heating at the final point of contact between the two contact faces was a factor of primary importance in determining whether arcing was likely to occur, and the speaker believed that other important factors were the variation in the contact resistance just prior to actual separation, the current passing at that instant, and the temperature of the contact faces as well as the degree of volatilisation that obtained, all of which tended to reduce the sparking voltage, looking at the two contacts as two electrodes separated by a short distance; and if the local heating was excessive just before separation, the resistance of the gap would be so small as to make the sparking voltage practically zero, so that from that standpoint the two theories would be brought somewhat into line.

At the present time, the most satisfactory contact metal was undoubtedly a platinum iridium alloy containing from 15 to 25 per cent. of iridium. Under certain conditions tungsten gave reasonably good results, but it was inferior to the platinum iridium alloy in respect of its range of adaptability, using

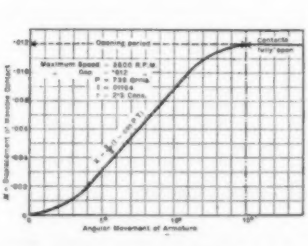

Fig. 12.—Displacement Curve.

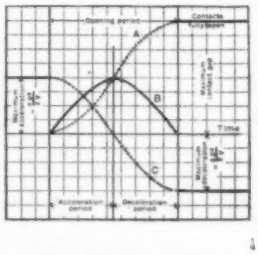

Fig. 13.—Analysis of Motion.

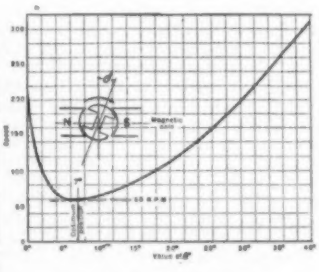

Fig. 14.—Relation between Sparking Speed and Pole Gap.

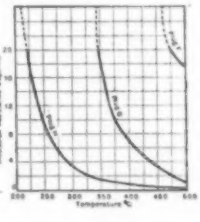

Fig. 15.—Plug Insulation Tests.

Note.—In fig. 13, A = displacement; B = velocity; C = acceleration.

introduced one to many interesting mechanical problems, whilst the phenomenon of contact arcing, if examined in great detail, led one to consider many difficult problems in the realms of metallurgy and physics. The condenser was one of the vital parts of a magneto. It had to be built into such a small compass that the problem of securing a suitable dielectric was a very difficult one. A great deal had yet to be learnt concerning the exact nature and magnitude of electrical and mechanical strains to which a condenser was subjected in service. The insulating parts, such as the distributor, slip ring, &c., were made of a moulded insulating material having a rubber base. The manufacture of those parts in moulds, starting with a plastic mass, introduced a branch of electrical engineering which had not in the past received adequate consideration, and the potentialities of that particular line of manufacture were very great. Finally, there were the interesting and complex problems involved in manufacturing that expression to denote such factors as current, flux and speed. Even so, however, it was the next best contact metal to the platinum iridium alloy, and on the battery-coil systems tungsten yielded satisfactory results. Probably, however, in the case of tungsten there was a critical value of the current which must not be exceeded no matter what the size of the contacts might be, and as the contact current in all battery-coil systems of ignition was much less than that in a magneto (see fig. 16), that was probably the reason why tungsten was used successfully in America. It would appear also that a humid atmosphere such as frequently obtained in this country had a more detrimental effect on the operation of tungsten contacts than it had in the case of a platinum iridium alloy. In a recent investigation that the speaker made on the subject he found there was a relationship between the performance of different materials, when used as magneto contacts, and the physical characteristics of the materials. Thus by arranging

different metals in their order of merit, as determined by their suitability for use as contact metals, starting with the best and going down the scale to the worst metal, the density diminished, the specific resistance diminished, whilst the heat conductivity increased. There was still a large amount of research to be done on the whole subject, and a careful investigation should yield results that would be of great benefit to the magneto industry. Fig. 17 showed how in a solid-pole machine the active flux in the armature core diminished with increase in speed, solely as a result of the eddy-current damping in the solid masses of iron through which the flux had to pass. The curves were plotted from results of tests carried out on a 6-cylinder Bosch magneto built during the war period. The flux dropped from about 32,000 at low speeds to 16,000 at a speed of 5,000 r.p.m. Corresponding to this reduction in flux the energy in the spark also fell off rapidly as the speed was increased. In using laminated poles it was an advantage to make the lamination as thin as possible. The speaker some time ago obtained a comparison between the operation characteristics of a magneto when it was fitted with pole pieces made up of laminations of different thicknesses. The thickness of lamination was increased from 0.016 in. in steps up to 0.064 in., a final series of tests being made with a solid cast-iron pole piece as generally adopted by the Bosch Co. The results obtained were as follows:—

(*a*) Minimum sparking speed, 70 r.p.m., 100 r.p.m., 130 r.p.m. Thickness of lamination, .016 in., .064 in. Solid pole piece.

(*b*) Peak voltage measured across a standard 5.5 m/m 3-point spark gap, 7,800, 7,700, 7,200. Thickness of lamination, .016 in., .064 in. Solid pole piece.

The above voltages were measured at a speed of 2,000 r.p.m.

(*c*) Energy in h.p. spark, .060 joule, .059 joule, .053 joule. Thickness of lamination, .016 in., .064 in. Solid pole piece.

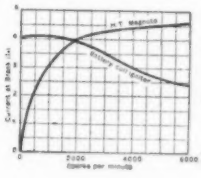

Fig. 16.—"Break" Current.

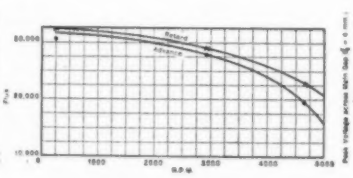

Fig. 17.—Variation of Armature Core Flux with Speed.

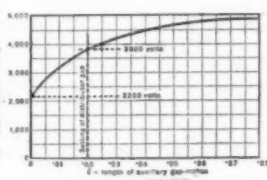

Fig. 18.—Efficiency of Auxiliary Spark Gap.

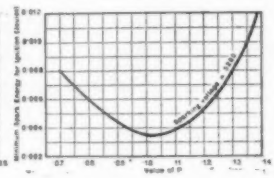

Fig. 19.—Spark Energy.

One of the difficulties that had to be contended with in the orthodox form of rotating-armature magneto was the variation in the minimum sparking speed that resulted from any adjustment of the timing lever. Fig. 14 was of special interest in that connection as showing the relationship between the minimum sparking speed and that particular gap in the case of a small laminated-pole 4-cylinder magneto. The curve was plotted from the results of tests, and showed the actual relationship existing between the minimum sparking speed and the angle θ, the latter being the inclination of the axis of the armature core to a line drawn at right angles to the magnetic axis when "break" occurred. There was a critical gap which gave the lowest minimum sparking speed, and in that particular design of machine that gap corresponded to an angle of θ of about 7 deg., *i.e.*, an actual air gap of about 2 m/m between the trailing edge of the armature core and the leading edge of the pole tip at the moment of "break." Most manufacturers "timed" their magnetos to give a gap of that order, so that when the timing lever was fully advanced, the minimum sparking speed was at its optimum value. When the timing lever was retarded, however, the minimum sparking speed increased rapidly, and various methods had been introduced, such as the use of extended pole pieces, to make that inequality as small as possible. Actually it was possible so to modify the ordinary rotating-armature magneto as to give uniform sparking over the whole timing range by introducing polar segments which were mechanically linked to the contact-breaker cam cage. Those segments were adapted to be rotated between the revolving armature and the fixed pole pieces with which the polar segments were in magnetic contact. In that construction, the air gap between the trailing edge of the armature core and the leading edge of the pole tip at the moment of "break" was constant for all positions of the timing lever, and as a result the intensity of the spark was uniform over that whole range. Such a magneto, particularly when it was used on high-powered engines, had a wonderful effect on the flexibility and performance of the engine, as it enabled the spark to be very considerably retarded, such, for example, as when going up a hill, without any appreciable reduction in power, as was likely to occur with the more usual form of magneto.

The speaker did not quite agree that from the point of view of enabling the magneto more readily to cope with excessive leakage in the h.p. circuit, the spark gap was of no material value. In support of this contention fig. 18 was of interest, which represented the results of tests made to determine the effect on the sparking voltage of a given gap connected to a magneto, of introducing in series with the gap a small auxiliary spark gap such as was used in the jump spark system. With a gap only 0.02 in. in length the sparking voltage across the main gap was increased from 2,200 to 3,800 volts, when a resistance of 112,000 ohms was connected in parallel with the main gap. The conditions obtaining in that test approximated somewhat closely to the worst conditions that might result in practice when the insulation resistance of the plug was reduced to a very low figure. Fig. 15 showed how the insulation resistance fell away very rapidly with increase in temperature in the case of three plugs fitted with different forms of insulator. Plug insulation resistances under working conditions which were as low as 100,000 or 200,000 ohms were not at all impossible, and when the magneto had to function under such adverse operating conditions, the speaker believed that the auxiliary spark gap was beneficial in enabling the voltage more quickly to rise to its maximum value than happened when there was no such spark in the h.p. circuit and the end of the secondary winding was connected directly to the plug.

The speaker could also hardly agree that the heat energy contained in the flame portion of the spark was of no value, and although Mr. Watson's contention was probably quite correct when applied to normal running conditions, it was the adverse operating conditions that really determined what the design of an efficient ignition unit should be. One of the most important considerations was that of starting, and when everything was cold the petrol entered the cylinder in the form of a mist, and the mixture to be exploded was not a homogeneous gas. Under those conditions the heat energy contained in the spark was of value in volatilising some of the minute petrol globules held in suspension in the air, thus forming in the vicinity of the spark plug electrodes an explosive mixture which approximated to the ideal.

Fig. 19 showed the amount of energy actually required to ignite an explosive mixture of petrol and air, the curve being taken from one of the papers written by Mr. Paterson and Dr. Campbell, giving the results of a large amount of research work carried out at the N.P.L. The curve showed that a spark containing as little energy as 0.0035 joule was sufficient to ignite an explosive mixture, and that amount of energy was less than one-tenth of that given by almost any form of magneto. Fig. 20 indicated the heat energy contained in the spark generated by different ignition units. In the case of the small magneto fitted with laminated poles (B), the energy in the

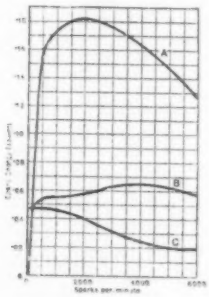

Fig. 20.—Spark Energy.

spark was maintained over the whole range of speed, whilst in the case of the larger solid-pole machine (A) the energy quickly reached a maximum and then fell rapidly away. The battery-coil system of ignition (C), on the other hand, gave a spark containing much less energy than that liberated by any form of h.p. magneto, the spark energy being a maximum at zero speed, and falling away gradually as the speed was increased.

Electrical Incubators.—The *Tanner and Stock Breeder* says that electricity is used for incubation to a small extent, the difficulty being in most cases distance from a source of supply. Better results can be had from electricity than from oil, gas, or coal, the temperature is always constant, there are no fumes, and labour is saved. The simple feature of this method is that the current is supplied through an ordinary plug-in terminal and cord to the machine, and a resistance with a sliding scale is fixed so that we can increase or decrease the temperature. Existing hot-air machines can be easily converted by a handy man in a short time if he has an elementary knowledge of electricity and magnetism.

THE RAILWAY BILL, 1921.

The Railway Bill which the Minister of Transport, Sir Eric Geddes, introduced into the House of Commons last week, is a complicated measure, filling nearly 70 printed pages. The present condition of the railways is the outcome of war, a reflex of trade conditions, and a result of great change in the economic handling of all great industrial undertakings. It is absolutely necessary that provision should be made to meet the changes that must ensue when control lapses in August next. Such changes should, of course, secure a greater efficiency in service, a large economy in management, and a gradual extension of the existing public facilities.

It has been decided in the first instance that the proper line of progress lies through the establishment of larger and better operating units. In order to abolish as far as possible competitive services for the same traffic, and a system of competition that exhausts competing railway lines without ultimate advantage to those they serve, it has been decided to bring about a wide measure of co-operation by organising the railways of Great Britain into six groups—amalgamating the principal lines, absorbing the smaller ones, and giving each group a strong incentive to develop the special area which it serves. In arranging these groups, operating economies and the financial position have been the determining causes, but it was clear from the outset that legislative action must stand in reserve behind negotiations.

The Railway Bill proposes to leave companies in the six groups to arrange their own amalgamation scheme, but if they cannot agree between themselves, a Railway Amalgamation Tribunal will be set up to take the responsibilities they are unwilling or unable to assume. A very large measure of assent has been obtained through negotiation with all the interests concerned, and at the time of bringing the Bill before the House of Commons only a few railways, including the Scottish companies, were in opposition to its principles. The position of the Scottish railways is a difficult one. They appear to have gone a little outside their usual practice in the matter of expenditure, and are undoubtedly rather uncertain about their own future. Scottish railway rates are on a lower basis than those obtaining in England, but the opinion is held that, with a return to normal trade conditions, they are at least sufficiently high to enable the Scottish Railway companies to maintain a standard of prosperity and efficiency.

Hitherto the principle on which rates have been regulated has been the establishment of maxima by statute. This has left the actual rates within the maxima to the discretion of the companies (subject, of course, to the Act of 1894), but this condition could not be maintained after the amalgamations outlined by the Bill came into force. Moreover, the Railway and Canal Commissioners, to whom all appeals lay hitherto, are an expensive body to approach, and their jurisdiction is limited. These Commissioners will retain very considerable powers. They will continue to act as arbitrators for the Ministry of Transport or the Board of Trade. They will exercise jurisdiction in Public or Private Acts and decide the services and facilities due from the railway companies in return for the advantages conferred upon them. But for the purpose of deciding the incidence of rating, a new Rates Tribunal is set up under the Bill, and the Tribunal will seek in general terms to impose upon each class of merchandise a fair share of the burden that railway companies must carry. The basis on which rates are to be fixed will be one designed to secure for each company a standard revenue, based upon that obtained in 1913, together with 5 per cent. upon capital expenditure made under Government control, and a further allowance in respect of large capital expenditure not fully remunerative in 1913. Rates established in the immediate future will be upon the basis of existing conditions, which cannot be regarded as stable; consequently these rates must be modified as conditions change. To this end they will be reviewed annually for three years, and thereafter at stated periods in the Minister's discretion. A standard revenue that would be invariable would go far to destroy that initiative in railway companies upon which both the general prosperity of the companies and the country must depend. Where the rates yield a return in excess of the standard, 80 per cent. of such excess will go in rate reduction and 20 per cent. to the revenue of the company earning it. We understand that the railway companies, the Federation of British Industries, and other bodies anxious to protect their respective interests and privileges are satisfied with the principles of the Bill.

The Light Railways Acts have not been nearly as effective as they were intended to be. The Ministry of Transport Act of 1919, empowers the Minister, with the consent of the Treasury, to make advances in aid of light railways without the restrictive conditions referred to. For the better promotion of enterprise in districts that would benefit greatly by the establishment of a light railway, the financial provisions of the Light Railways Acts will be repealed and the provisions of the Ministry of Transport Act will take their place. The Act in many ways encourages light railway enterprise, notably by giving such railways higher charging powers than main lines, and also securing to them a proportion out of the rates which will reflect these higher powers.

The proposed relations between the boards of management and the employés of the railway companies have lately undergone a change. The original intention of the Government was that workers should be represented on the boards of the various new groups, and although this decision was opposed strenuously by the Railway Companies' Association the Government had arrived at a very carefully considered decision and was not disposed to modify it in response to pressure. In the light of this decision, which was of definite value as a basis for bargaining, the National Union of Railwaymen, the Associated Society of Locomotive Engineers and Firemen, and the Railway Clerks' Association—the three largest unions connected with the railway service—entered into direct negotiation with the railway companies, and arrived at an agreement which makes for peace and tranquillity in the service, and is conditional, as to its principal provisions, on the understanding that the Railway Bill shall contain no other references to management or conditions of service than those to which the parties chiefly concerned have agreed. The workers have withdrawn their original demand for representation on boards of directors, and in place they have accepted a scheme of joint councils of officers and elected employés. These councils will function along the lines of Clause 16 of the Whitley Report. The agreement maintains the Central and National Wages Boards, subject to a twelve months' notice which may not be given before January 1st next (1922). Each of the parties to the agreement will have several representatives on the boards and, in default of agreement between the unions and individual railway companies on questions relating to payment, hours and conditions of service, reference will be made to the Central and National Wages Boards, provided that the constitution of this body does nothing to prejudice such appeal. Provision is made for the setting up of a committee consisting of six representatives of the companies and six representatives of the unions to prepare schemes for carrying this new agreement into effect.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR APRIL, 1921.

It is satisfactory to note that, in face of an enormous fall in the general trade figures during the month of April owing to the effects of the dispute in the coal industry, electrical goods were practically unaffected, and, in fact, showed an increase in several items and in the total export figure. This last increase was equivalent to about 18 per cent. above the March total. A large but probably easily accounted for increase was apparent in the export of submarine telegraph and telephone cables, the April value being more than four times that of the previous month. The value of railway and tramway motors exported also increased three-fold, and rises occurred in the export values of arc lamps and parts, switchboards, glow lamps, batteries, and insulated wire. Falls occurred in telegraph and telephone apparatus, unenumerated electrical goods, and other items. The total value of imports fell by just over 11 per cent., the decrease being fairly evenly distributed over the constituent items. A decline of 11 per cent. also occurred in the re-export figure, chiefly occasioned by a large drop in the value of re-exported unenumerated goods and apparatus.

VALUES OF ELECTRICAL EXPORTS AND IMPORTS FOR APRIL, 1921.

	Exports.	Imports.	Re-exports
Electrical goods and apparatus (unenumerated)	£198,537	£81,803	£5,213
Insulated wire	392,638	7,155	—
Glow lamps	53,499	38,049	7,647
Arc lamps and parts	2,152	1,743	—
Batteries	74,436	9,680	—
Meters	43,452	16,921	9,040
Carbons	3,178	7,913	183
Electrical machinery :—			
Railway and tramway motors ...	27,421	—	—
Other motors and generators ...	219,070	—	—
Electrical machinery (unenumerated)	176,266	52,157	3,696
Switchboards (not telegraph or telephone)	22,507	106	23
Telegraph and telephone cable and material :—			
Telegraph and telephone wire and cable (not submarine)	127,681	10,605	100
Submarine telegraph and telephone cable	387,949	—	—
Telegraph and telephone instruments and apparatus	130,680	37,028	2,974
Totals... ...	£1,858,866	£263,160	£28,876

Coming Norwegian General Strike.—The Christiania correspondent of *The Times* says that Trade Union leaders and the Socialist Press emphasise that the general strike, which is to commence on May 26th, has no political character, and that its only object is to prevent a reduction of wages. Conservative and Liberal papers prophesy that the strike will prove a great failure.

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

12,271. "Electric transformers." Metallurgique Electrique. April 28th. (France, October 29th, 1920.)
12,272. "Electric insulators." Metallurgique Electrique. April 28th. (France, October 29th, 1920.)
12,273. "Conductors for dynamo-electric machines." Brush Electrical Engineering Co., Ltd., and C. C. Sutton. April 28th.
12,317. "Electric motor starting and controlling switchgear." C. C. Garrard, A. H. Railing, and W. Wilson. April 29th.
12,318. "Synchronising systems." Western Electric Co., Ltd. April 29th. (United States, May 1st, 1920.)
12,344. "Means for operating track-sanding apparatus of tramway, &c., vehicles." G. A. Bradfield and M. F. Keen. April 29th.
12,352. "Sound receiving equipment for ships." Signal Ges. April 29th. (Germany, May 31st, 1920.)
12,364. "Electrical fitting connections." J. A. McKay. April 29th.
12,370. "Electro-magnetic relays, &c." Automatic Telephone Manufacturing Co., Ltd. April 29th. (United States, May 6th, 1920.)
12,379. "Electric lighting, heating, and ventilating installations for railway, &c., vehicles." A. H. Darker and J. Stone & Co., Ltd. April 29th.
12,381. "Induction train control systems." J. B. Regan. April 29th.
12,386. "Electric switches." Bristol Tramways & Carriage Co., Ltd., and B. A. Payne. April 29th.
12,397. "Magneto-electric generators for internal combustion engines." C. P. Godfree. April 29th.
12,406. "Current conducting wire for hermetically brazing in glass." W. P. Thompson (Vereinigte Gluhlampen-und Elektrizitats Akt.-Ges.). April 30th.
12,420. "Screen for head lamps, &c., to eliminate glare." V. W. Turner. April 30th.
12,450. "Electrical means for operating mechanisms by sound." C. P. Ryan. April 30th.
12,454. "Electric radiators." H. Harrison and J. R. Quain. April 30th.
12,460. "Means for obtaining high-voltage electrical impulses." N. W. McLachlan. April 30th.
12,464. "Thermo-electric generator of steam." G. Durando. April 30th. (Italy, April 30th, 1920.)
12,469. "Electric switches." R. W. Bill and H. Heath. May 2nd.
12,470. "Auxiliary electric light for use with acetylene lamps, &c., on motor vehicles." W. H. Date. May 2nd.
12,500. "Movable letter electric sign for cars." R. Winterburn. May 2nd.
12,501. "Means of generating electricity." J. Evans. May 2nd.
12,515. "Device for converting alternating into continuous current for feeding three-electrode thermionic tubes, &c." R. Vallette. May 2nd. (France December 9th, 1920.)
12,532. "Appliance for registering telephone calls." C. F. Kubec and J. Phillips. May 2nd.
12,544. "Ignition arrangements for internal combustion engines." A. E. Lamkin. May 2nd.
12,561. "Telegraphic apparatus." M. B. Rodriguez. May 2nd.
12,562. "Electric meters." F. Holden. May 2nd.
12,566. "Dynamo-electric machine group." A. F. Beach. May 2nd.
12,573. "Process for electrolytic production of potassium carbonate from potassium chloride solutions." Chemische Fabrik Griesheim-Elektron and R. Suchy. May 2nd.
12,580. "Telephone call recorder." L. Boyes and E. R. Simmonds. May 2nd.
12,638. "Cable attaching device for fixing electric cables to carbon brushes." E. Gindre. May 3rd.
12,642. "Electrical controllers." Metropolitan-Vickers Electrical Co., Ltd. May 3rd. (United States, May 17th, 1920.)
12,654. "Telephone exchange systems." L. Polinkowsky and Western Electric Co., Ltd. May 3rd.
12,656. "Electrical boiling rings." Electric Fires, Ltd., F. L. Newhouse, and C. H. Smith. May 3rd.
12,658. "System of electric current distribution." C. A. Turner. May 3rd.
12,663. "Electric switches." H. Lucas and W. C. Turner. May 3rd.
12,690. "Signalling devices for telephone, &c., systems." Automatic Telephone Manufacturing Co., Ltd. May 3rd. (United States, June 1st, 1920.)
12,694. "Duplex, &c., telegraphy." H. W. Sullivan. May 3rd.
12,703. "Secondary batteries." Hart Accumulator Co., Ltd., and F. J. Holmes. May 3rd.
12,704. "Secondary batteries and secondary cell containers." Hart Accumulator Co., Ltd., and F. J. Holmes. May 3rd.
12,719. "Electric terminals." W. Owens. May 4th.
12,727. "Apparatus for switching electricity, gas, or liquids on or off." C. Sugden. May 4th.
12,744. "Means for conveying electric current from overhead wires to tramcars." C. G. Millington and W. Sharp. May 4th.
12,746. "Transmitting photographs, messages, &c., by telegraphy." E. W. Whiston. May 4th.
12,749. "Arc generators and methods of regulating same." T. E. Robertson (S. Davis). May 4th.
12,762. "Sparking plugs." J. F. Spalding. May 4th.
12,765. "Ignition system for internal combustion engines." C. E. James and C. Lamb. May 4th.
12,776. "Telephone exchange systems." L. Polinkowsky and Western Electric Co., Ltd. May 4th.
12,785. "Electric burglar alarms." Polyp Ges. Fur Apparatebau der Feinmachanik Ges., and G. Wittwer. May 4th.
12,810. "Manufacture of metal tubes by electrolytic deposition." M. A. Jullien. May 4th.
12,836. "Machine for registering telephone calls." S. Gayner. May 5th.
12,857. "Electrical fuse bridge." W. E. Flower. May 5th.
12,863. "Resistance grid for electric motor starters, &c." J. Schuil. May 5th.
12,881. "Electric fuses." W. Clark and Clark's Neo Electric Devices, Ltd. May 5th.
12,882. "Commutators." A. H. Steptoe and E. G. Steptoe. May 5th.
12,896. "Selective switches." Western Electric Co., Ltd. (Western Electric Co., Inc.). May 5th.
12,902. "Electrical machines with fan ventilation." Siemens-Schuckertwerke. May 5th. (Germany, May 5th, 1920.)
12,906. "Spark gaps." L. H. T. Holden. May 5th.
12,917. "Controlling mechanism of tramway, &c., switches." S. S. Wrightson. May 5th.
12,922. "Apparatus for converting alternating to direct electric currents and vice versa." J. E. Calverley and W. E. Highfield. May 5th.
12,923. "Electric switches." R. A. R. Bolton. May 5th.
12,935. "Electrical plug switches, &c." E. Jones. May 6th.
12,942. "Dynamos for automobile, &c., electric lighting systems." C. A. Miller, F. J. Miller, and E. A. Sanders. May 6th.
12,953. "Electric switches." F. H. Restall. May 6th.
12,962. "Electric bell set." T. Hewitt. May 6th.
12,987. "Magnetic cut-out." G. Terry. May 6th.
12,994. "Alternating current motors." M. Dewhurst and Dewhurst and Partner, Ltd. May 6th.
13,010. "Method of producing drawn tungsten wires." Patent-Treuhand Ges. fur Elektrische Gluhlampen. May 6th. (Germany, May 7th, 1920.)
13,021. "Electric signalling and telegraphic devices, &c." E. O. Symonds. May 6th.
13,030. "Circuit connection fittings for electric wiring systems." L. M. Waterhouse. May 7th.
13,033. "Annunciator signs." R. N. Chubb. May 7th. (United States, May 8th, 1920.)
13,041. "Joint for tramway rail." L. P. Davies and K. James. May 7th.
13,044. "Radio-signalling systems." Radio-Communication Co., Ltd., and J. Scott-Taggart. May 7th.
13,059. "Time limit relays, circuit breakers, &c." B. H. Leeson, J. Mirrey, and A. Reyrolle & Co., Ltd. May 7th.
13,063. "Automatic electric door bolt and release." S. H. Lacey. May 7th.
13,068. "Electric switches." H. W. F. Ireland and H. Lucas. May 7th.
13,069. "Electric heating, drying, &c., apparatus." W. Hayhurst. May 7th.
13,071. "Portable electric tool for drilling, reamering, tapping, &c." F. W. White and White, Jacoby & Co., Ltd. May 7th.
13,084. "Dynamo-electric machinery for electric welding." Brush Electrical Engineering Co., Ltd., and P. Huggins. May 7th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1919.

25,403. "Wireless signalling." E. F. W. Alexanderson and General Electric Co. October 16th, 1919. (United States, October 16th, 1918.) (136,965.)
25,579. "Connecting electric currents." L. Seblini. October 18th, 1919 (France, October 19th, 1918.) (134,211.)
25,718. "Connecting electric currents." L. Seblini. October 21st, 1919. (France, June 4th.) (Addition to 134,211.) (144,242.)
27,196. "Electric heat-producing element and applications thereof to apparatus or articles." C. H. Roddis. November 5th, 1919. (Cognate application, 31,711/19.) (162,012.)
28,500. "Electric gas lamps with glow discharge." J. Pintsch Akt.-Ges. November 6th, 1917. (Patent of addition not granted.) (135,486.)
28,872. "Electricity meters." Chamberlain & Hookham, Ltd., and S. James. November 20th, 1919. (162,015.)
30,143. "Safety tram shackle." J. Leadbeater, D. Weeks, and E. D. Williams. December 3rd, 1919. (162,018.)
30,176. "Devices for electrically measuring the lengths of electric cables." W. E. Benson and Callender's Cable & Construction Co., Ltd. December 3rd, 1919. (162,019.)

1920.

452. "Electrically-heated cooking device." C. C. Armstrong. June 27th, 1916. (137,526.)
1,184. "Transmission gearing for electric motors." E. Small and W. S. Smith. January 14th, 1920. (162,286.)
1,387. "Rotating interrupting devices for high-speed sparking apparatus." O. Imray (Bosch Akt.-Ges., R.). January 15th, 1920. (162,039.)
1,467. "Machine for the automatic and continuous production of seamless boxes, lamp sockets, and other articles by electrolysis." S. O. Cowper-Coles. January 16th, 1920. (162,042.)
1,763. "Protective arrangements for electric distribution systems." A. Reyrolle & Co., Ltd. (J. C. van Staveren). January 20th, 1920. (162,059.)
1,773. "Electrical step-by-step devices for indicating and other purposes." K. Higginson and Carey-Cavey Syndicate, Ltd. January 20th, 1920. (162,061.)
1,871. "Wireless telegraphy and telephony." W. H. Eccles and J. H. Vincent. January 21st, 1920. (162,067.)
1,872. "Device or apparatus for testing the sparking plugs of internal combustion engines." J. B. Tucker. January 21st, 1920. (162,068.)
1,955. "Means for adjusting brake shoes used in tramway vehicles and the like." S. Thomas. January 21st, 1920. (162,073.)
2,354. "Electric switch of the tumbler type." S. E. Foster. January 26th, 1920. (162,086.)
2,378. "Electrically-heated irons." H. Cheshire and V. Summerhayes. January 26th, 1920. (162,088.)
2,542. "Electric protective devices." British Thomson-Houston Co., Ltd. (General Electric Co.). January 27th, 1920. (162,093.)
2,687. "Wireless telegraphy and telephony." E. Hoghton and Portholme Aircraft Co., Ltd. January 28th, 1920. (162,097.)
3,701. "Systems of regulation for electric circuits." British Thomson-Houston Co., Ltd. (General Electric Co.). February 6th, 1920. (162,118.)
3,803. "Electric switch boxes and the like." W. T. Henley's Telegraph Works Co., Ltd., and W. H. Nicols. February 7th, 1920. (162,119.)
3,922. "Electrically-operated diaphragm horns." B. A. Quint and A. R. Kearney. February 9th, 1920. (162,120.)
4,467. "Magnetic blow-out devices for electric switches and the like." T. Zweigbergk. February 13th, 1920. (162,128.)
6,229. "Electro-magnetic brakes." Igranic Electric Co., Ltd. (Cutler Hammer Manufacturing Co.). March 1st, 1920. (162,145.)
6,542. "Battery charging systems." Automatic Telephone Manufacturing Co., Ltd. June 11th, 1919. (144,611.)
9,225. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. May 28th, 1919. (143,842.)
9,236. "Method of and apparatus for manufacturing electric incandescent lamps." Westinghouse Lamp Co. April 3rd, 1919. (141,049.)
9,861. "Controlling mechanism for electric circuits." Industrial Research Corporation. April 28th, 1920. (142,451.)
11,665. "Portable electric lamps." Fullers United Electric Works, Ltd., and L. Fuller. April 27th, 1920. (162,183.)
13,780. "Electrically-heated perforator." A. B. Campbell. May 19th, 1920. (Addition to 122,771.) (162,199.)
14,186. "Electric projector lamps for motor vehicles." A. J. Curnow and Howes & Burley, Ltd. May 25th, 1920. (162,202.)
16,034. "Arrangements for the coupling of two alternating current electric systems in parallel." Ateliers de Constructions Electriques Du Nord et de l'Est. January 22nd, 1914. (145,022.)
16,310. "Suppression of sparking at the interruption of conductors, traversed by current." Siemens-Schuckertwerke Ges. July 29th, 1915. (145,072.)
18,140. "Regulating means for electrical machines." Soc. Anon. des Etablissements L. Bleriot. February 20th, 1919. (Addition to 130,575.) (145,775.)
19,362. "Oil break switch in which the gas pressure generated upon its being opened accelerates the movable contact in the direction of the switching-out motion." Allgemeine Elektricitats Ges. April 1st, 1914. (147,456.)
21,541. "Covers for electric switches, and the manufacture therefor." S. S. Sodring and N. P. E. Winther. July 17th, 1920. (162,220.)
22,727. "Electro-magnetic overload cut-outs." S. Krupp Akt.-Ges. August 7th, 1919. (149,673.)
29,236. "Arrangement and construction of sparking plugs for internal combustion engines. E. L. Muller. October 16th, 1919. (152,609.)
36,084. "Electric lamps operating with luminous discharge." J. Pintsch Akt.-Ges. December 12th, 1917. (155,783.)

1921.

6,912. "Electrically-heated melting and other furnaces." Morgan Crucible Co., Ltd., and C. W. Speirs. October 7th, 1919. (Divided application on 161,603.) (162,246.)